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Seasat Gulf of Alaska Experiment Workshop
Volume II. Comparison Data Base Conventional
Marine Meteorological and Sea Surface
Temperature Analyses, Appendixes A and B

Jet Propulsion Lab.
Pasadena, CA

Prepared for

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Washington, DC

Apr 79

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16. ABSTRACT

Appendix A forms a collection of the surface analyses performed for the Seasat Gulf of Alaska Experiment Workshop. Scalar fields are sea level pressure (SLP), surface air temperature (SAT), sea surface temperature (SST), dew point temperature, (DPT) and cloud cover. Two types of wind fields are shown. One is derived from sea level pressure and thermal fields, the other is a direct analysis of ship and buoy wind reports. A brief description of meteorology for the days used as intercomparison data for the Seasat sensors is given. Appendix B documents a subroutine library for deriving earth-located time series of geostrophic, gradient, and surface winds from polar stereographic grid-point fields such as those generated at the National Meteorological Center and Fleet Numerical Weather Central. The library also contains a program for plotting sea-level pressure analyses and vector arrows, based upon the NCAR graphics package, and an objective analysis program using the Cressman technique. Spherical geometric calculations involving polar stereographic grids are internal to the programs. (Author extracted)

17. KEY WORDS AND DOCUMENT ANALYSIS

17A. DESCRIPTORS

*Meteorological data, *Boundary layer, Cloud cover, Weather, Sea level, Wind (meteorology)

17B. IDENTIFIERS/OPEN-ENDED TERMS

Sea Surface temperature, *Gulf of Alaska, *Seasat, Wind field, Geostrophic wind

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Volume II., Comparison Data Base: Conventional Marine Meteorological and Sea Surface Temperature Analyses, Appendixes A and B

Edited by
Peter Woiceshyn

April 1979

National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

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SEASAT GULF OF ALASKA EXPERIMENT

CONVENTIONAL ANALYSES

CONTRIBUTORS

R. Brown (Univ. of Washington)

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P. Woiceshyn (JPL)

M. Wurtele (U.C.L.A.)

January 1979

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SECTION A-1
INTRODUCTION

SECTION A-1

INTRODUCTION

This report forms a collection of the surface analyses performed for the Seasat Gulf of Alaska Experiment Workshop. Scalar fields are sea level pressure (SLP), surface air temperature (SAT), sea surface temperature (SST), dew point temperature, (DPT) and cloud cover. Two types of wind fields are shown. One is derived from sea level pressure and thermal fields, the other is a direct analysis of ship and buoy wind reports. A brief description of meteorology for the days used as intercomparison data for the Seasat sensors is given on p. A-6A.

The basic procedure employed for all fields was to obtain ship and buoy reports, satellite photographs and film loops, and operational field products from NOAA nad/or FNWC. For the fields required, an extensive hand analysis was made for the synoptic times close to the transit times of Seasat. This hand analysis consisted of plotting all available spot reports and contouring the field as the reports dictate, then identifying and locating precisely all the fronts with high and low pressure centers on the available satellite imagery (pictures and film loops). Manual digitization of the fields was employed so that further computer processing could be made.

Three groups of people were responsible for the generation of fields. One group was led by J. Overland of NOAA/PMEL and P. Woiceshyn of JPL, a second group led by V. Cardone of Oceanweather, Inc., and a third group at UCLA led by M. Wurtele.

Emphasis for the Overland/Woiceshyn fields was on the following Seasat passes:

Rev No.	Date (September 1978)	Time (approximate GMT)
1140	14	18:00
1169	16	18:00
1183	17	18:00
1212	19	18:00
1298	25	18:00

In some cases, alternate analyses are included as performed by different analysts. The collection also includes selected analyses for orbits other than those listed above.

Emphasis for the Cardone fields was on the following Seasat passes.

Rev No.	Date (September 1978)	Time (approximate GMT)
1134-1135	14	09:00
1140	14	18:00
1292	25	09:00
1298	25	18:00

Cloud cover and precipitation analyses were produced by Wurtele:

(1) On maps, in code indicating the extent of cloud cover and the probability of precipitation within delineated areas.

(2) Numerically at 1° lat/long grid points, quantifying the probability of precipitation within grid squares centered at these points.

Emphasis for these analyses was on:

Rev No.	Date (September 1978)	Time (approximate GMT)
1134	14	07:30
1135	14	09:00
1140	14	17:15
1298	25	12:98

A brief description of the above fields is given in the paragraphs below. The final products derived were "standard-sized GOASEX charts" and digitized field parameters on computer cards. These parameters were spaced approximately 90 km apart on what is known as a "quarter mesh" grid.

Included in Appendix A is a collection of the surface analyses performed for the Seasat Gulf of Alaska Experiment by Overland/Woiceshyn at NOAA PMEL in Seattle. Scalar fields are sea level pressure (SLP), surface air temperature (SAT), sea surface temperature (SST), air-sea temperature difference (A-S), dew point temperature (DPT), and cloud cover. The wind fields shown are derived from sea level pressure and thermal fields. Examples of these fields are shown below.

The figure on page A-5a illustrates diagrammatically the procedure for the production of marine boundary-layer wind fields from grid-point pressure fields.

The procedure for hand-analyzing fields began with hand plotting ship, weathership, buoy, and land reports on a chosen stereographic projection. An example of a hand analyzed field is shown in

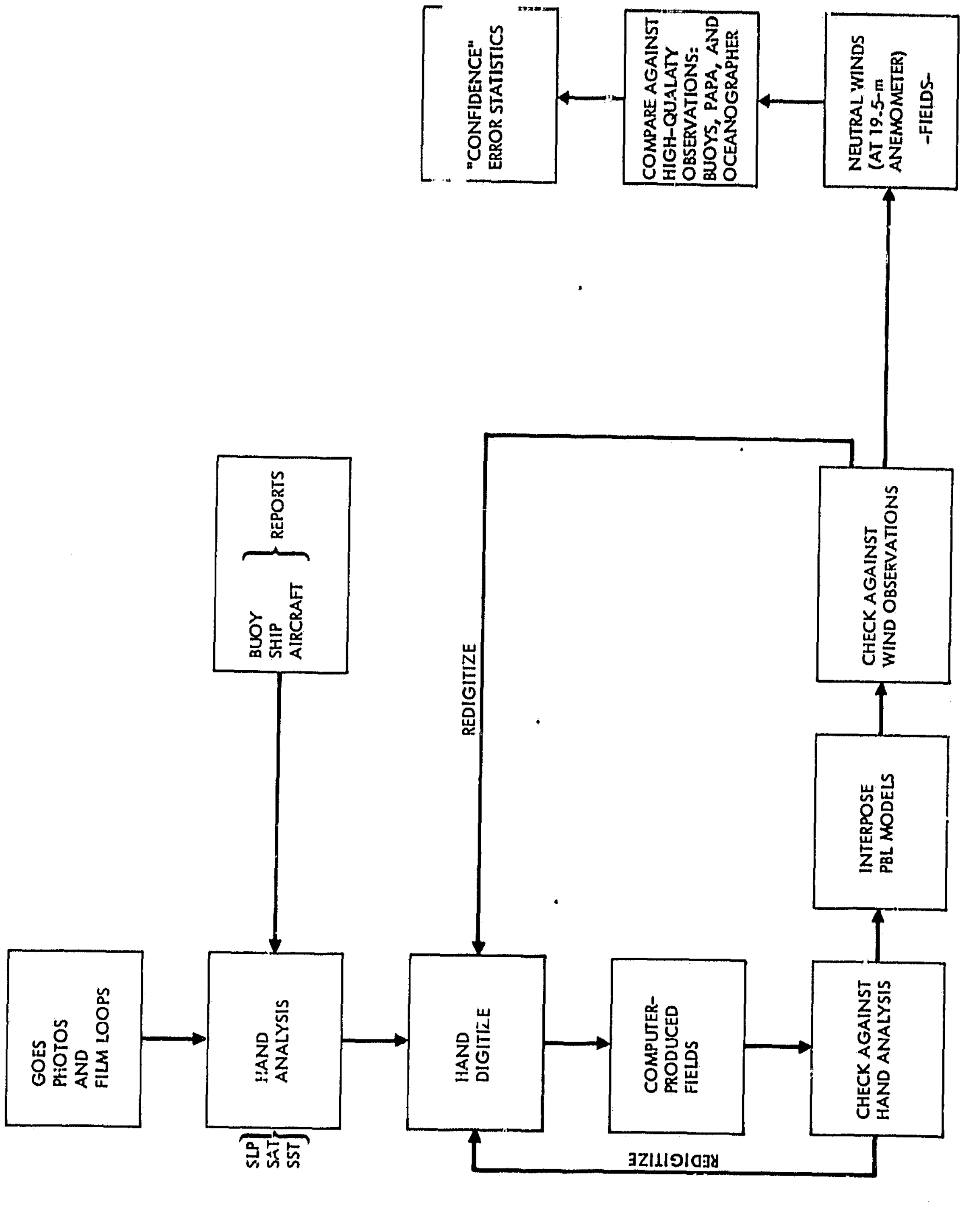

Figure A-1. Production of Marine Boundary Layer Wind Fields From Grid-Point Pressure Fields

figure on p. 23. The fronts and centers of vorticities (lows and highes) are located from satellite imagery as shown in the figure on p. A-14.

The hand analyses were manually digitized on a uniformly spaced mesh (grid) and plotted with the NCAR graphics routines. The "mesh" is four times the resolution of the standard NMC produced mesh. The computer-produced fields are checked for consistency against the fields drawn manually. The following are examples of hand-analyzed and digitized fields made by Overland/Woiceshyn for Rev 1298 (September 25, 1978). The figure on page A-46 illustrates the hand-analyzed surface air temperature (SAT) field; figure on page A-51 the digitized SAT; figure p. A-28, the hand-analyzed sea-surface temperature (SST) field (a 3-day average for 00:00, and 18:00 GMT observations); figure on p. A-33, the digitized SST; figure on p. A-56, the computed air-sea (A-S) temperature difference field; and figure on p. A-111, the digitized sea level pressure (SLP) field. Figure on p. A-111 also shows the computed wind field using the University of Washington planetary boundary layer (PBL) model. The scale wind vector on the bottom right hand side below the figure represents a 20-m/s length.

Section A-2 provides hand analyses of SLP and the accompanying GOES satellite photographs for each orbit. The conversion for wind reports is 10 kt is equivalent to one long bard.

Section A-3, -4 and -5 provide SST, SAT, and DPT fields. The hand analyses were digitized on a uniformly spaced mesh and plotted with NCAR graphics routines.

Section A-6 describes the cloud cover and precipitation analyses performed at UCLA.

Section A-7 describes the procedure for performing the kinematic wind field analyses. Relative quality estimates are assigned to 2.5° latitude-longitude regions based upon observation density and type of platform.

Section A-8 discusses wind fields derived by two planetary boundary layer models.[1] Digitized fields of SLP were converted to surface-gradient winds.[2] The digitized SAT and SST fields are used by the models to calculate 19.5 m anemometer height winds from the gradient wind field. Quality flags are assigned to 2.5 deg latitude longitude boxes. This section also discusses error sources in generating wind fields due to: buoy and ship anemometer measurements; height corrections due to atmospheric stratification; barometric sensor measurements; sparse measurements in the primary regions of analysis; and inadequately defined PBL physics. Also mentioned in Section A-8 is a brief description of the PBL models used in the PMEL derived wind fields.

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[1] The model 6 wind fields employed Cardone's (Oceanweather, Inc.) PBL model, while the model 8 wind fields utilized Brown's (Univ. of Washington) PBL Model. Both are described in Appendix B.

[2] The scale wind vector labeled maximum at the bottom right corner of each figure is <u>always</u> 20 ms^{-1}.

In Section A-9, derived wind fields are compared wtih spot observations and "confidence" statistics are determined.

Following the hand analysis fields are the figures of the hand-digitized and computer plotted fields. The computer plotted fields contain the word "observed" in the title of the figures in the following sections.

SECTION A-2
SEA LEVEL PRESSURE AND GOES PHOTOGRAPHS

SYNOPTIC PRECIS

Sept 14, 78 The surface chart (p. A-16) and the GOES imagery at 18:00 GMT on September 14, 1978 (corresponding to Rev 1140 p. A-8, show a deep low pressure center with much cloud cover and precipitation in the extreme north of the Gulf of Alaska, with strong westerly winds to the south of it, speeds 35-45 knots. There is an abrupt shear (wind shift) line, just possibly frontal in structure, parallel to the Canadian coastline, separating these westerlies from SW and even S direction, with much weaker speeds.

The sub-tropical High, oriented WSW-NNE, is broken into three cells, separated by a weak but identifiable cold front across the entire chart. The juncture of this front with the shear line parallel to the coast is an area of heavy cloud and precipitation. A small cyclonic vortex (typhoon remnant?) is centered at 37N, 140W, somewhat to the south-east of the front. Thus, almost the southern two-thirds of the chart is a region of weak (~ 5 kt) winds of uncertain direction.

The exception to this last statement is the area immediately adjacent to the California coast. Here the position of the Pacific High and a low aloft over Nevada produce (aloft) a strong easterly pressure gradient. In the unstable air off the coast, this momentum is transported downward to produce super geostrophic northerlies, on the order of 30 to 45 kts.

Sea-surface temperature (SST) isotherms (p. A-25) are essentially westerly in orientation, except for a ridge of relatively warm water along about 130 W and the usual cold upwelling region off California. This coastal region is the only operational portion of the chart with a significant gradient in air-sea temperature (p. A-52).

Sept 16, 78 By 18:00 GMT September 16 (Rev 1169, p. A-19), the Low center in the GOA has filled by 37 mb, and moved somewhat eastward, resulting in weaker WNW winds to the south (~25 kts). The cold front is almost completely washed out on the eastern half of the chart, and the High is a single cell centered rather far north (45N, 143W).

The strong northerlies off California persist, but now enter a diffluent region in a portion of which they become somewhat less strong (20-30 kts) ENE and E winds to the south of the High center.

SST and air-sea difference patterns (pp. A-26 and A-53) retain the same significant features.

Sept 17, 78 The Low in the GOA has filled completely by 18:00 GMT on September 17 (p. A-20), and been replaced by a ridge extending northward from the High centered at 41N 140W. No fronts are present on the eastern half of the chart. Thus, there is a strong NNW flow (25-35 kts) from off Queen Charlotte's Island, parallel to the Canadian and U.S. coastlines all the way to the bottom of the chart.

The remainder of the region around the dominating High (central pressure 0.035 mb) is characterized by weak winds; but in the northwest corner of the chart, a new frontal system is entering, terminating in a closed Low (1002 mb; 45N, 158W). The fronts are associated with marked wind shifts.

The SST pattern is unchanged, but the strong northerly flow has resulted in a region of minimum air-sea difference of about -4 deg (see p. A-54), centered off northern California (40N, 130W).

Sept 19, 79 The frontal system and Low mentioned for September 17 now, at 18:00 GMT September 19 (Rev 1212), dominate the northern Pacific (p. A-21). The Low has deepened to 990 mb, centered in the extreme northern GOA, and the front is along the Alaskan-Canadian coast. The front trails off to the SW, dividing the High into two cells.

Strong westerlies (30-40 kts) extend across the GOA, becoming southerly at the coast east of the front. The strong northerlies persist off California.

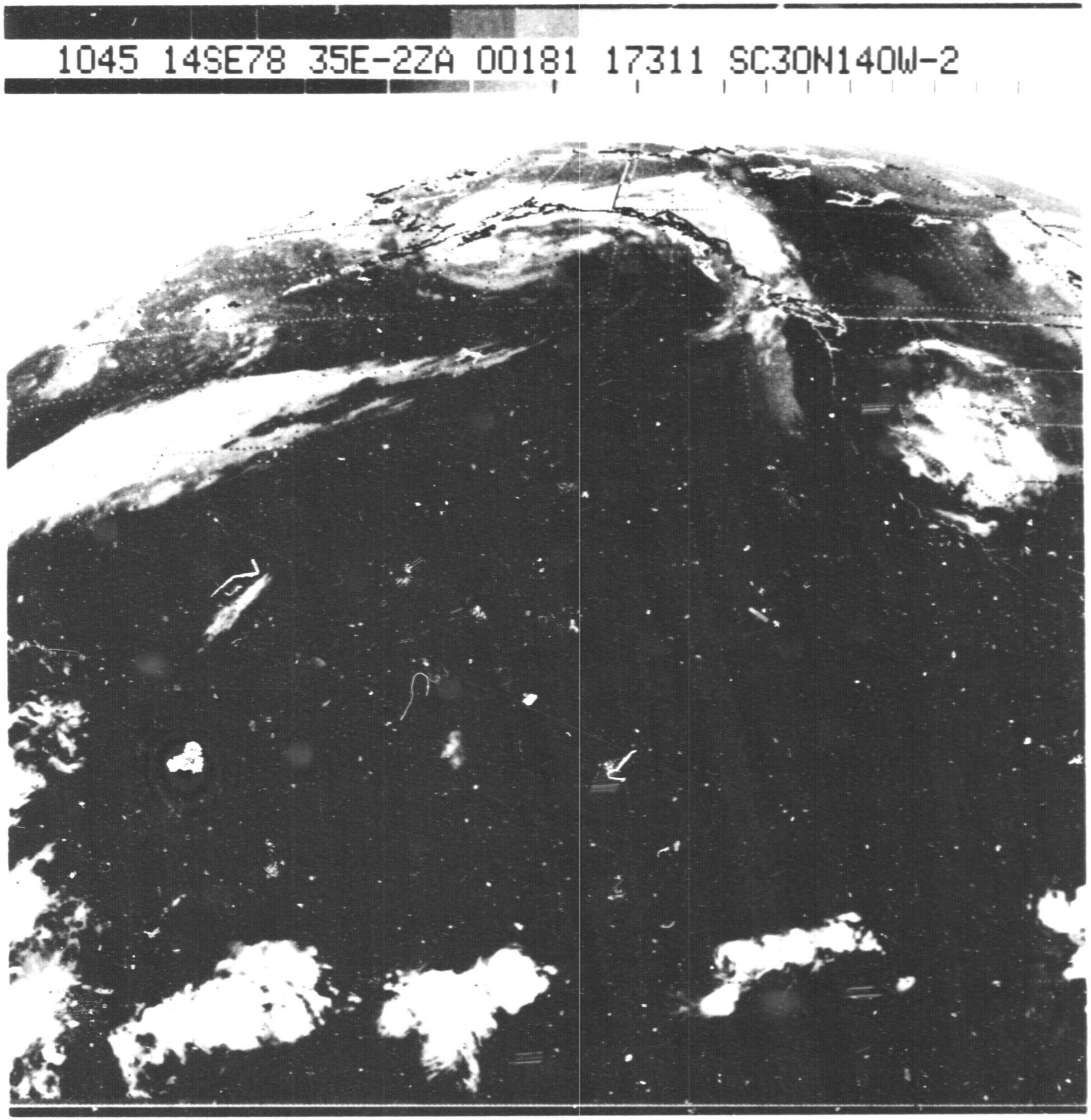
Thus, the surface chart is very similar to that of 18:00 GMT September 14 (Rev 1140).

The air-sea difference graident (p. A-55) is, however, unusually strong in the central Pacific, owing to a minimum of -4 deg (40N 155W) not far from maximum of +2 deg (42N, 138W).

Sept 25, 78 The chart at 18:00 GMT on September 25 (Rev 1298, see p. A-23), is the reverse of that of September 14 (Rev 1140, p. A-16). A double low (994 mb) occupies that portion of the Pacific usually reserved for the High, and the northermost GOA has a High center (1025 mb) at 57N 145W.

The costline from California northward is thus a region of southerly flow, and across the GOA are easterlies of speeds on the order of 20-30 kts. In this belt of easterlies is a very heavy cloud cover with cumulonimbus and precipitation.

Along N-S oriented front through a Low centered at 48N 165W has entered the extreme western portion of the chart, with extensive cloud cover.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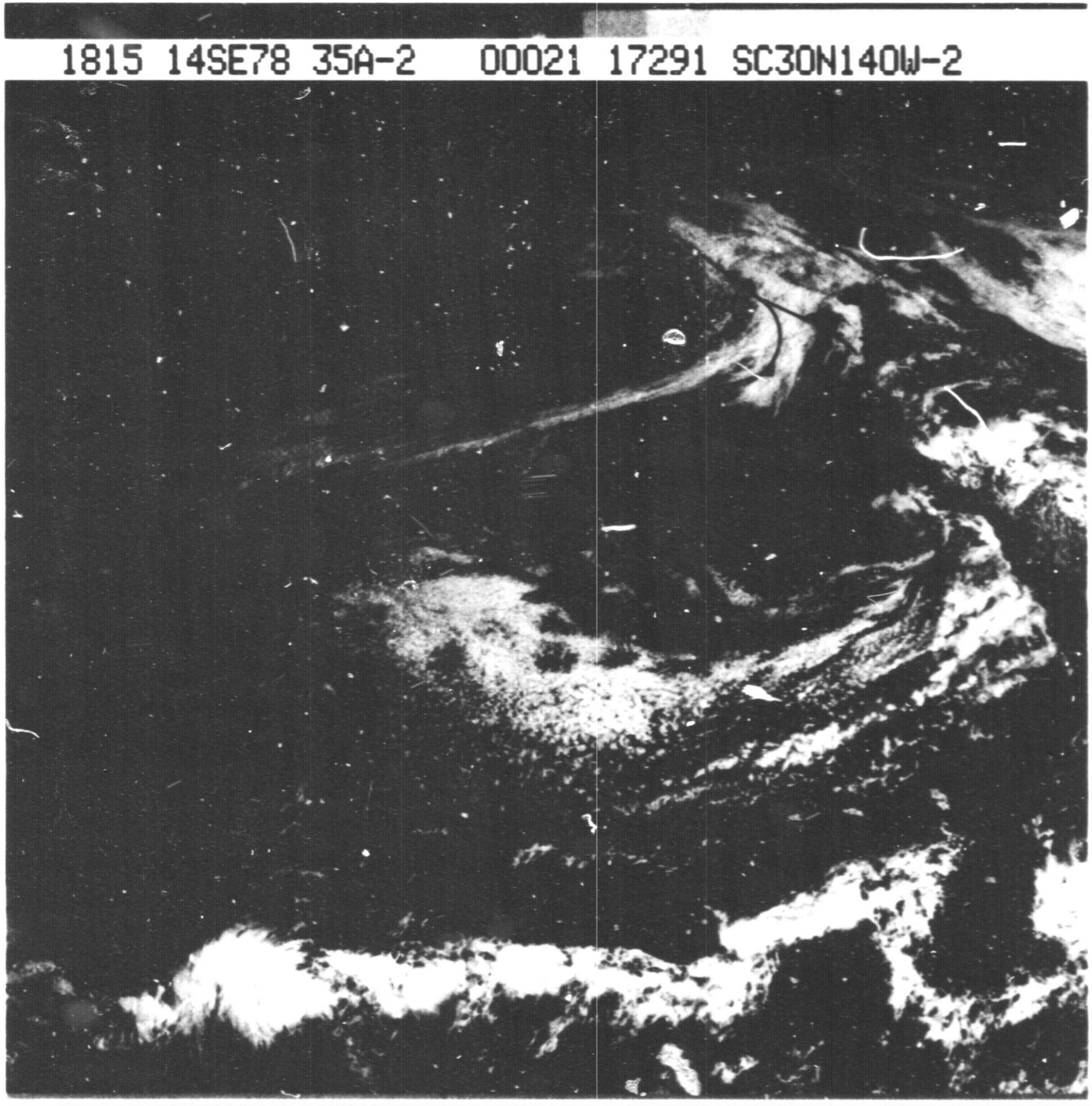
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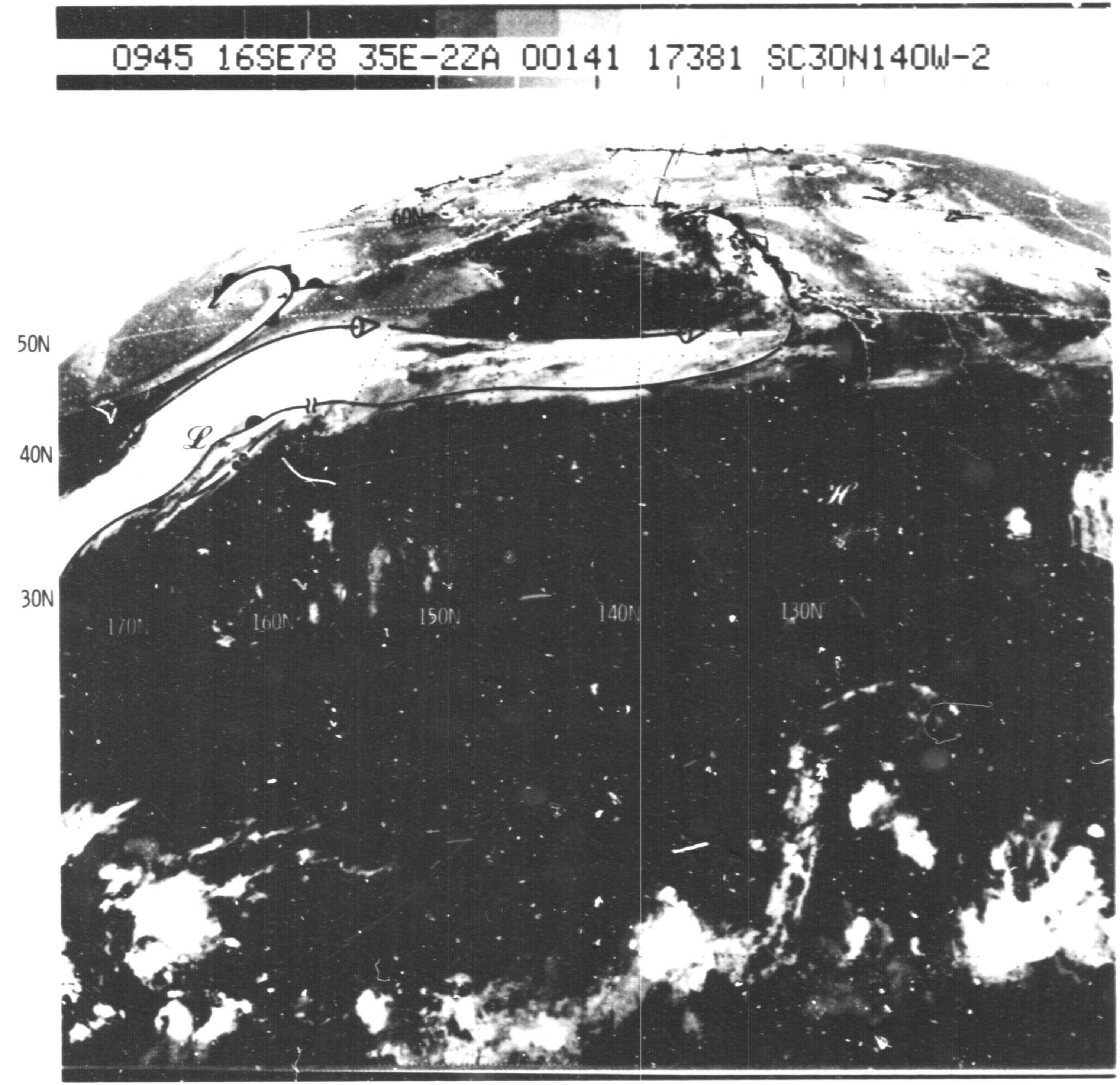

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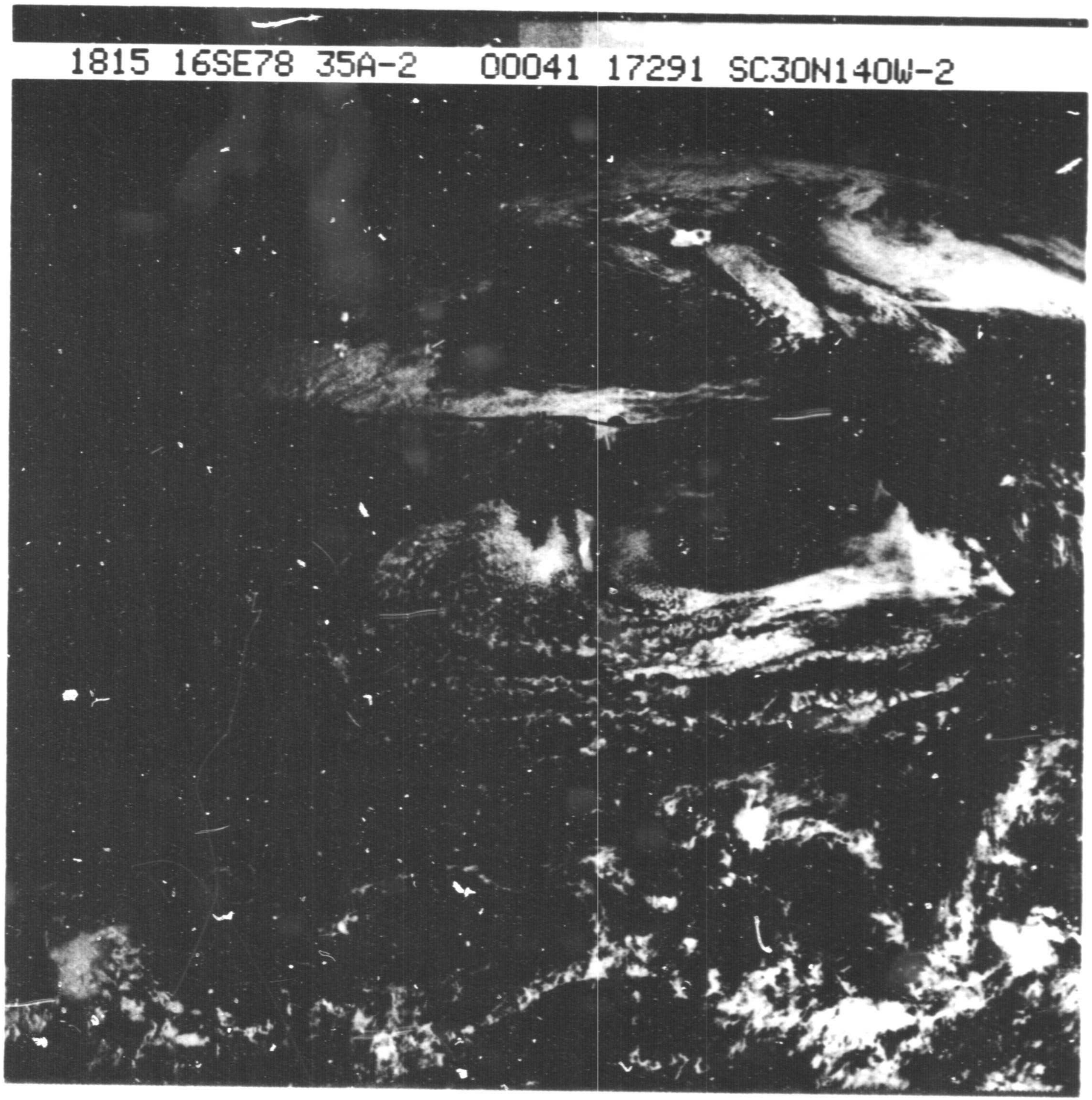
50N
40N
30N
L
H
170N
160N
150N
140N
130N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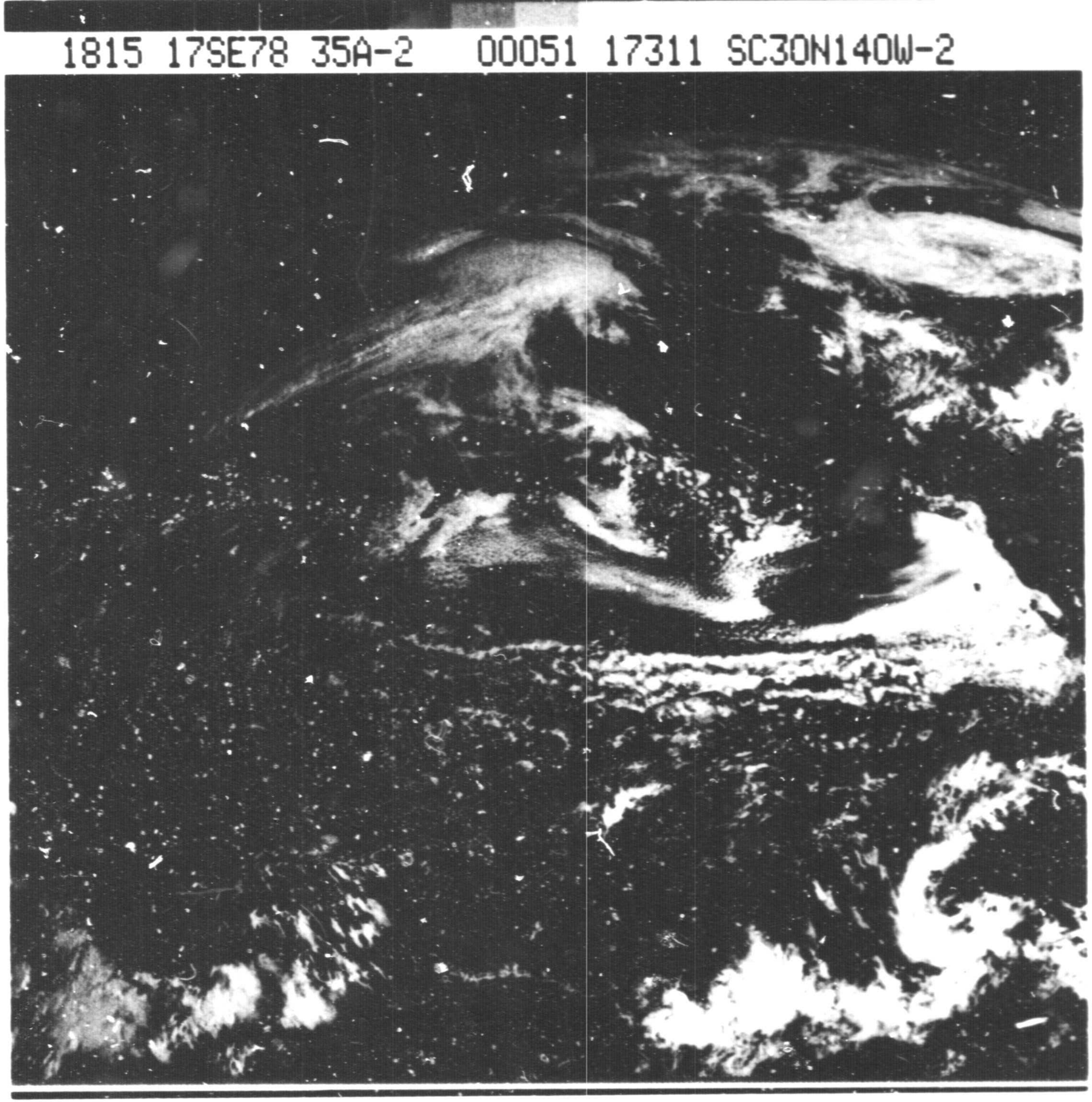
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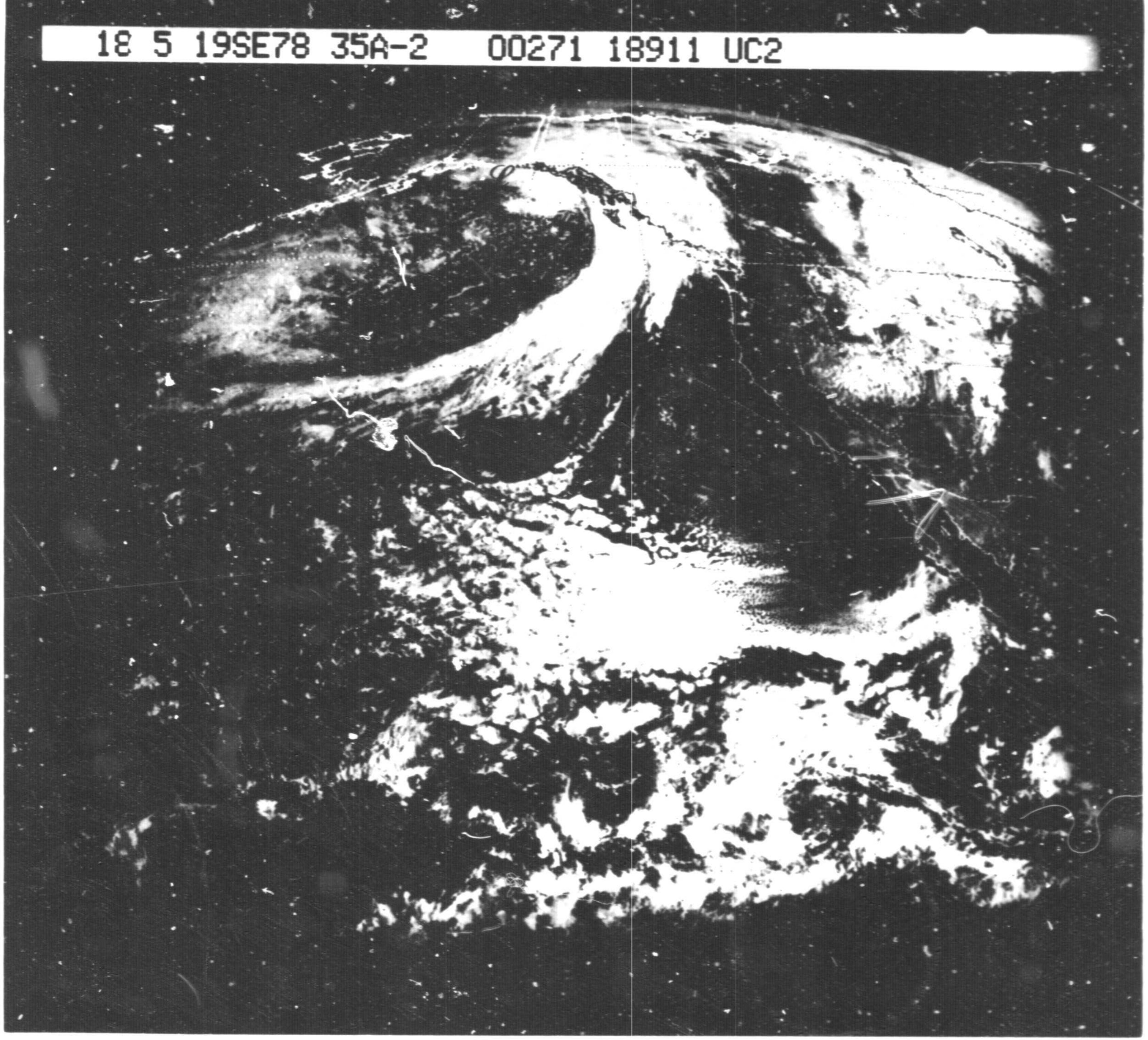
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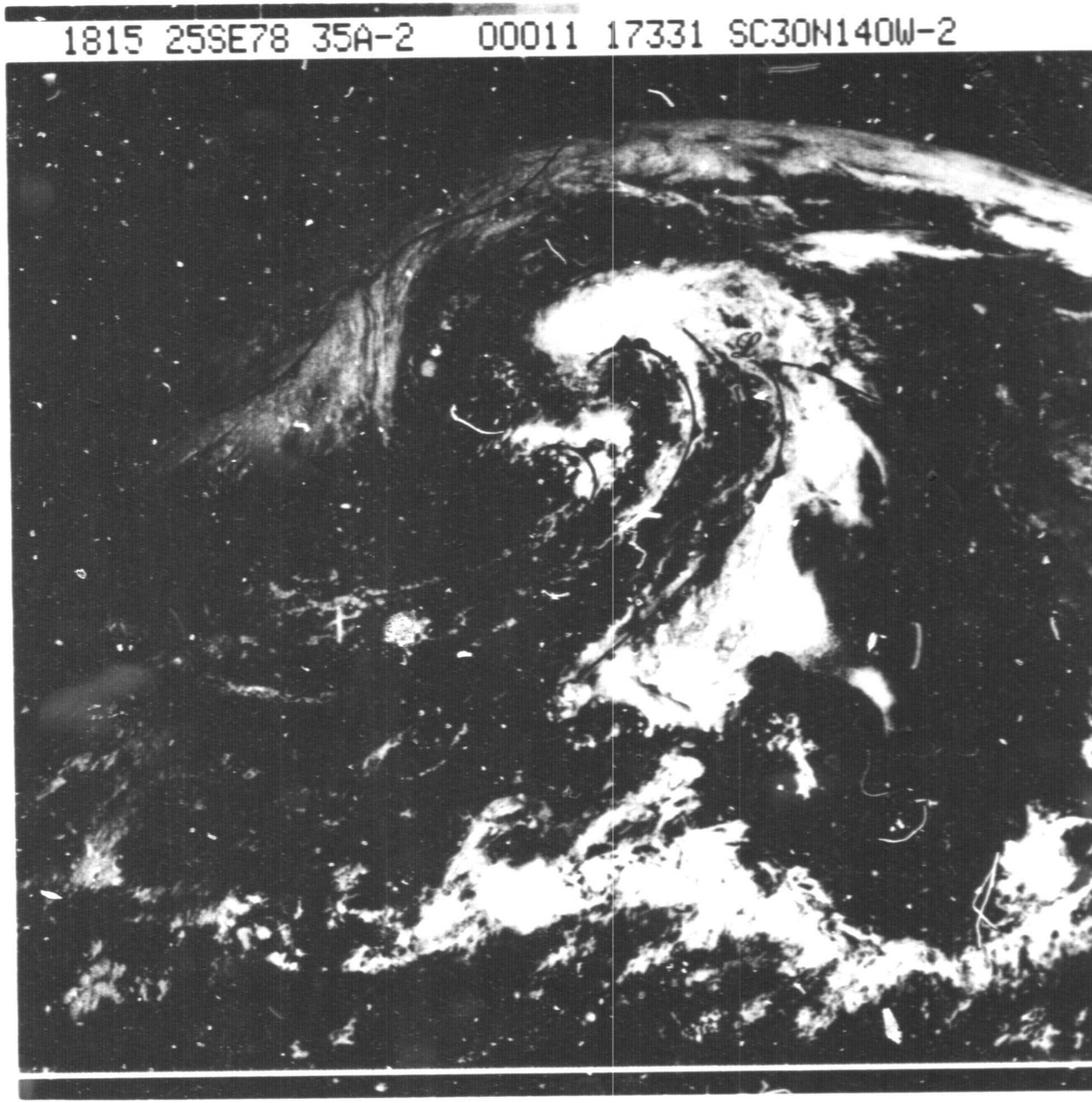
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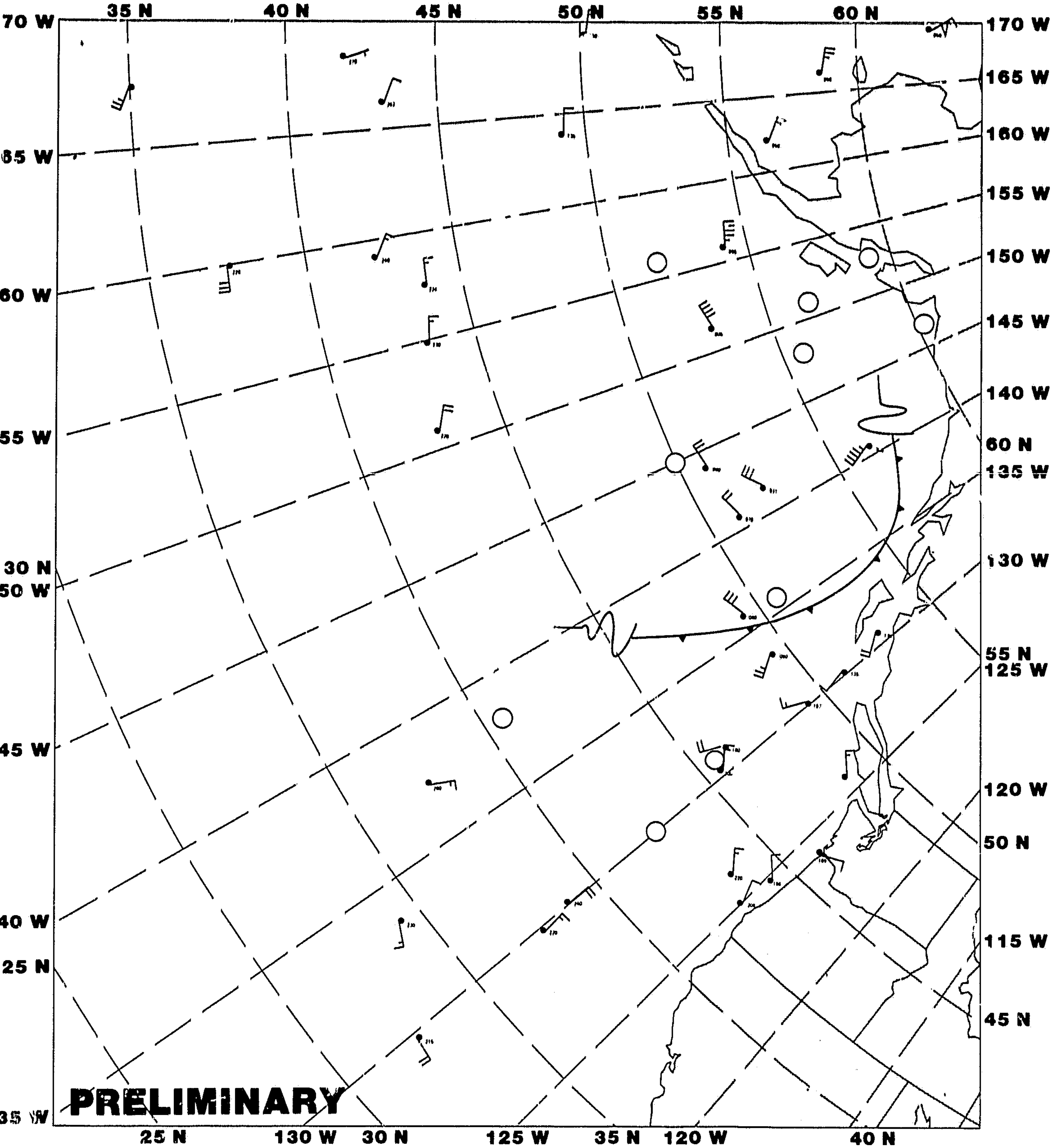
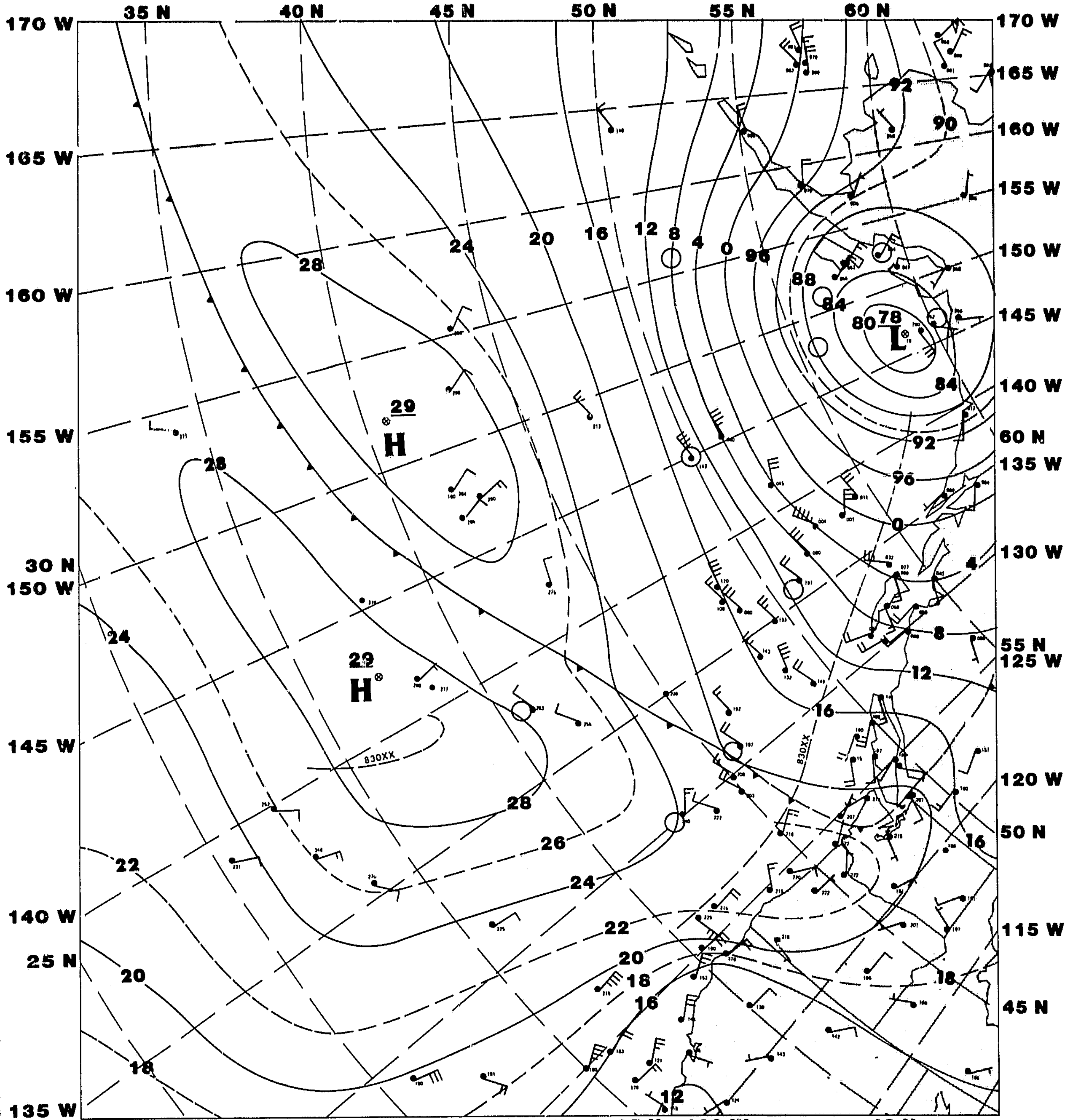
SEA LEVEL PRESSURE (SLP) AND OBSERVED WINDS (KNOTS)



06Z 14 SEPT 1978

REV 1134

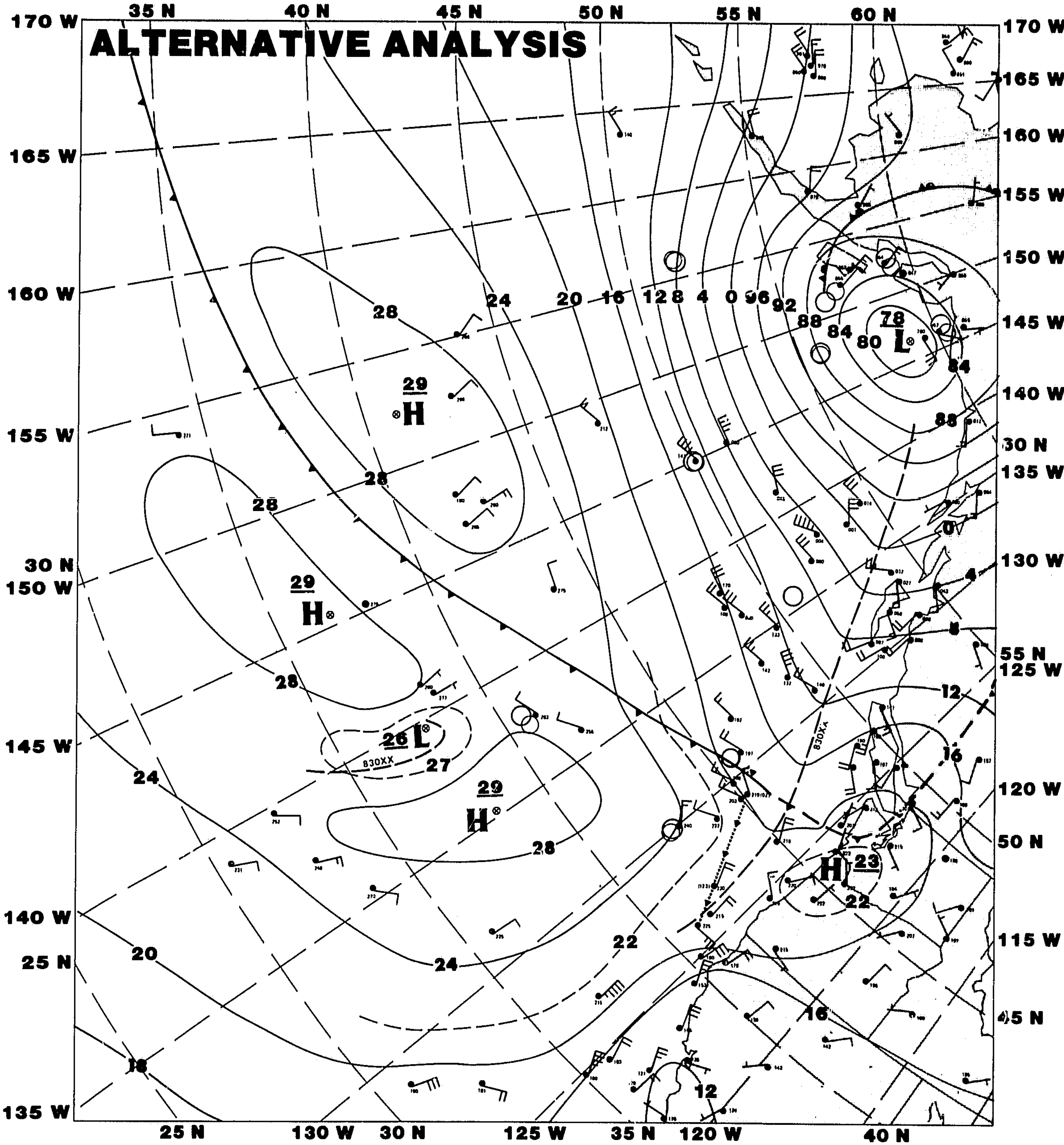
SEA LEVEL PRESSURE (SLP) AND OBSERVED WINDS (KNOTS)



A-16

18Z 14 SEPT 1978 **REV 1140**

SEA LEVEL PRESSURE (SLP) AND OBSERVED WINDS (KNOTS)



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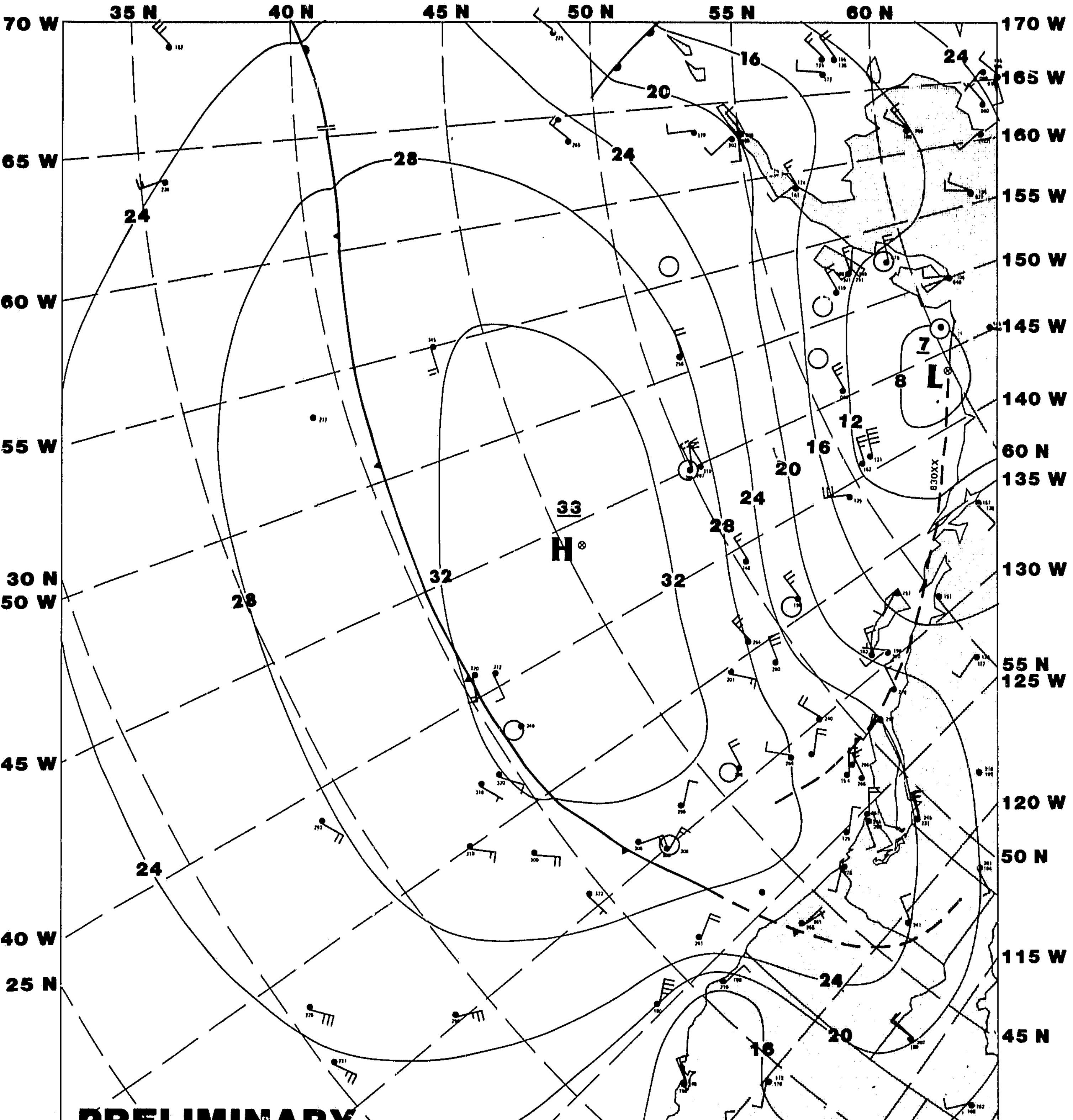
SEA LEVEL PRESSURE (SLP) AND OBSERVED WINDS (KNOTS)



09Z 16 SEPT 1978

REV 1163,1164

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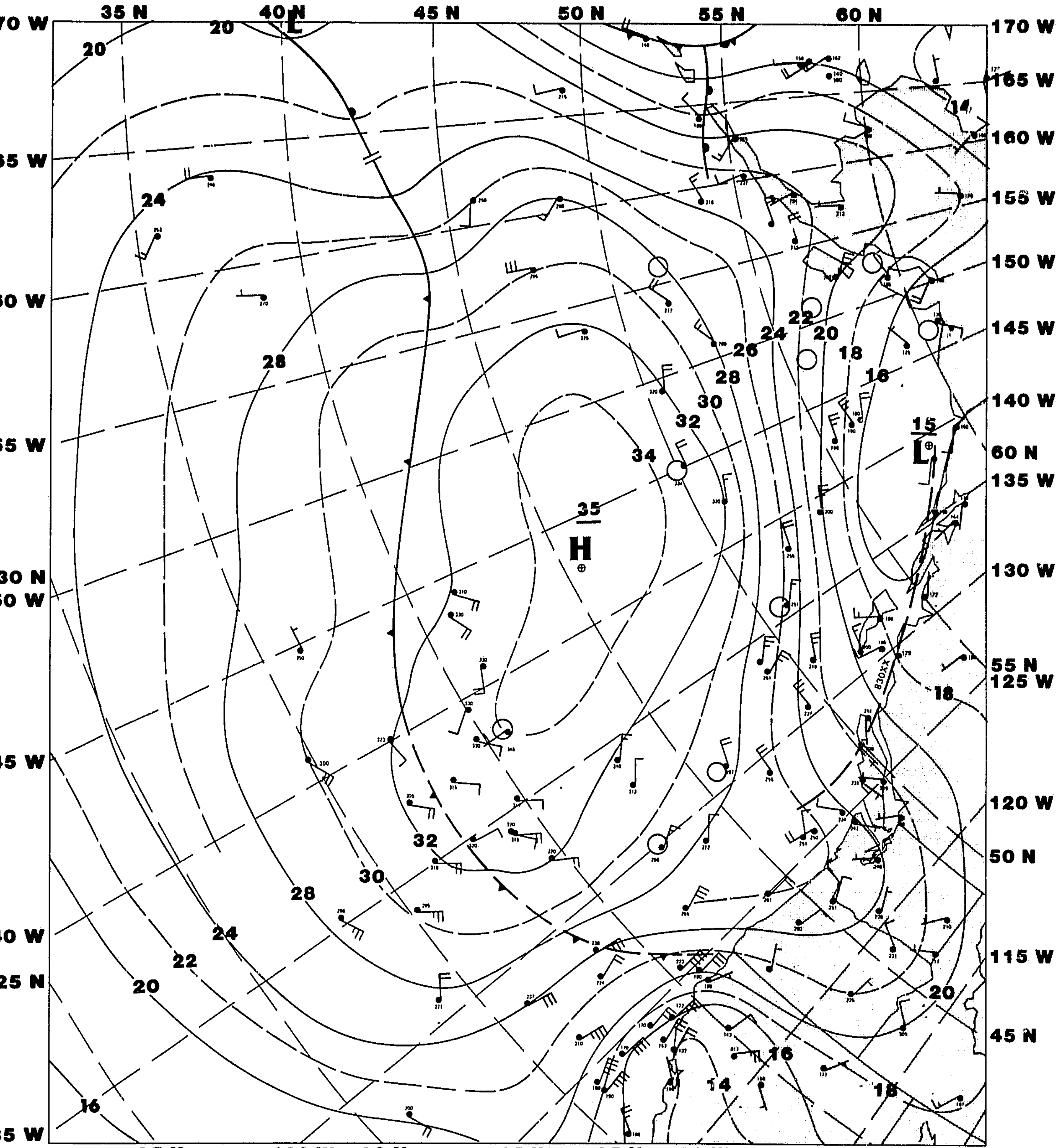
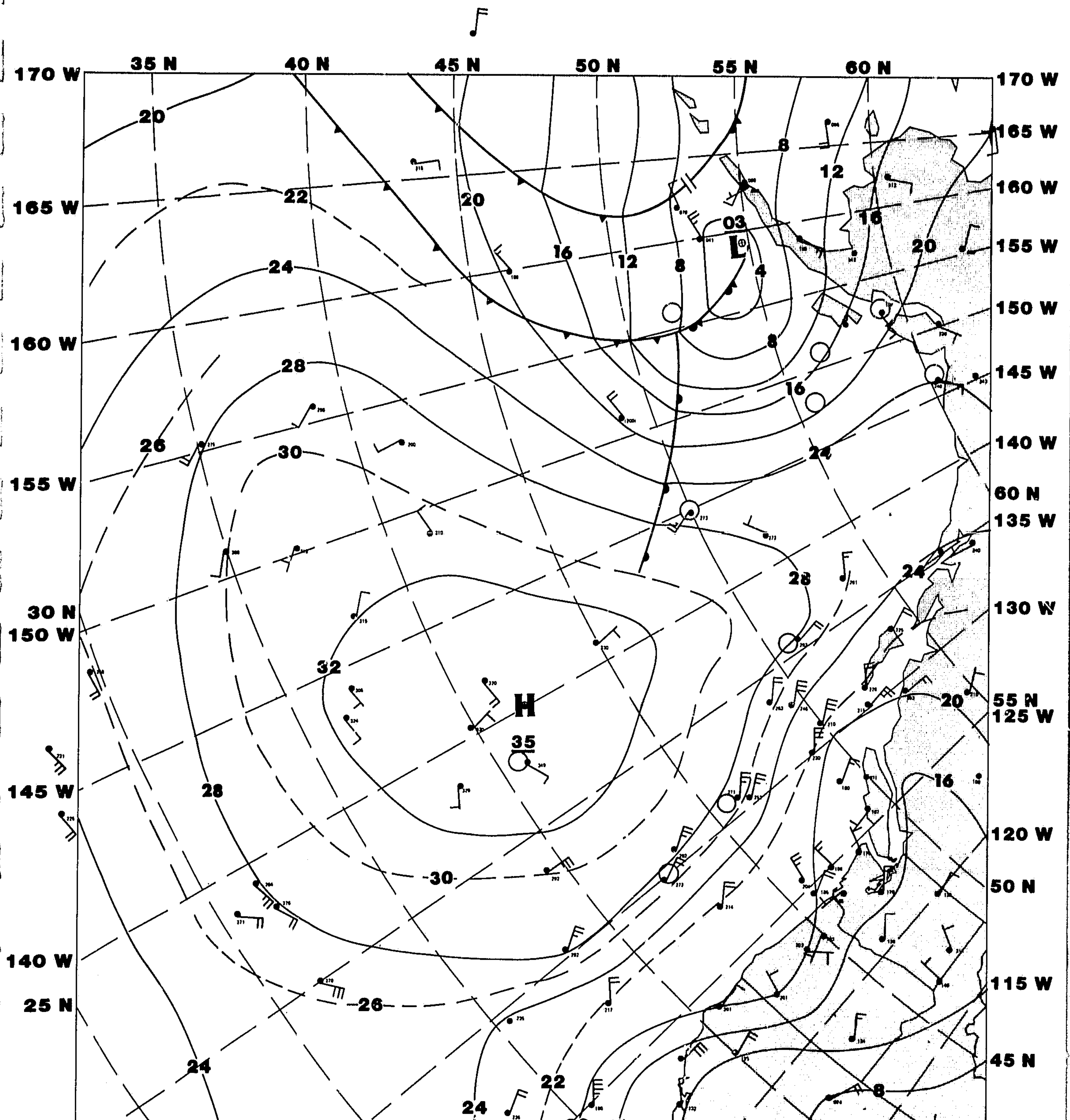


18Z 16 SEPT 1978

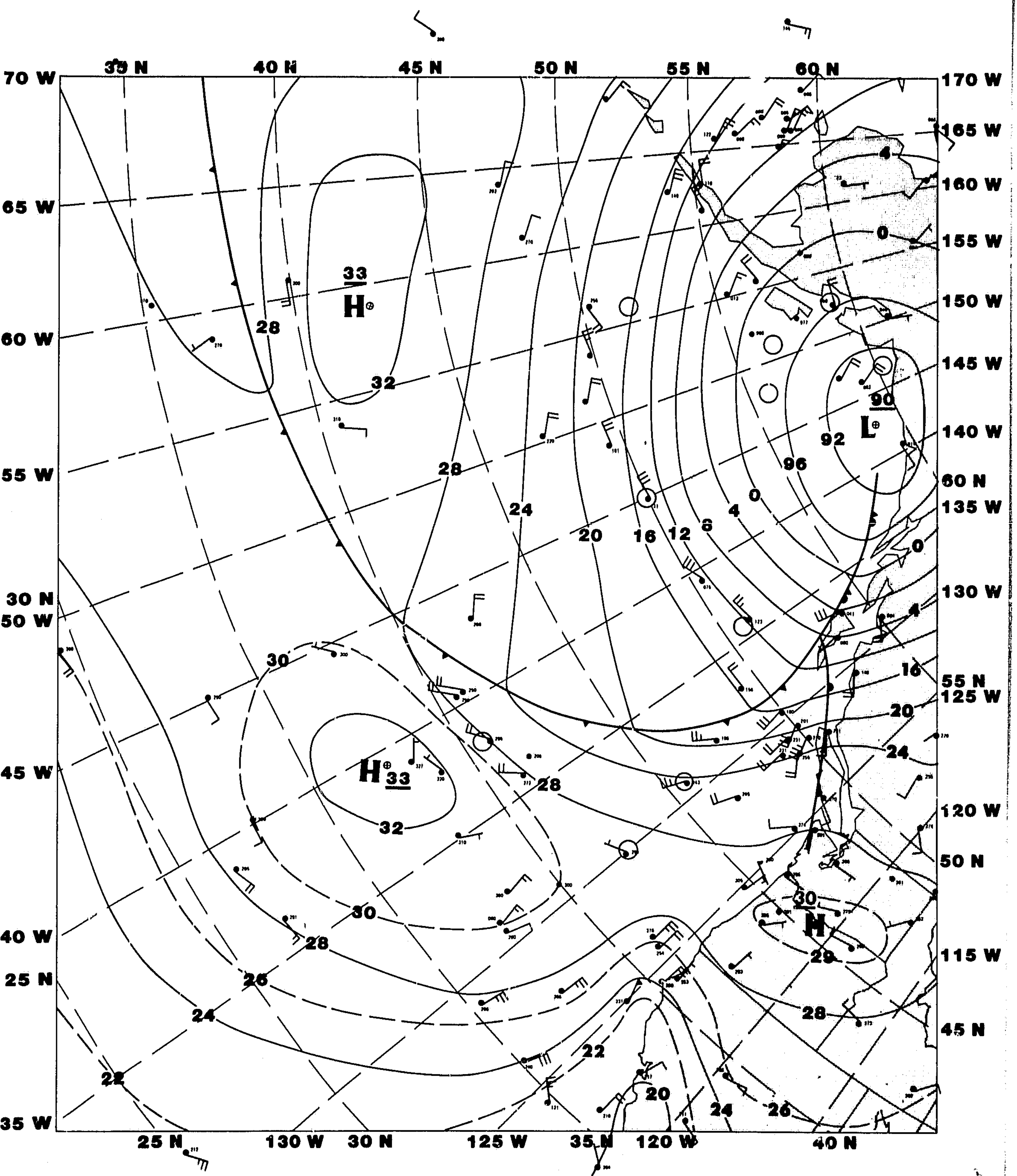
REV 1169

SEA LEVEL PRESSURE (SLP) AND OBSERVED WINDS (KNOTS)



18Z 17 SEPT 1978 A-20 **REV 1183**

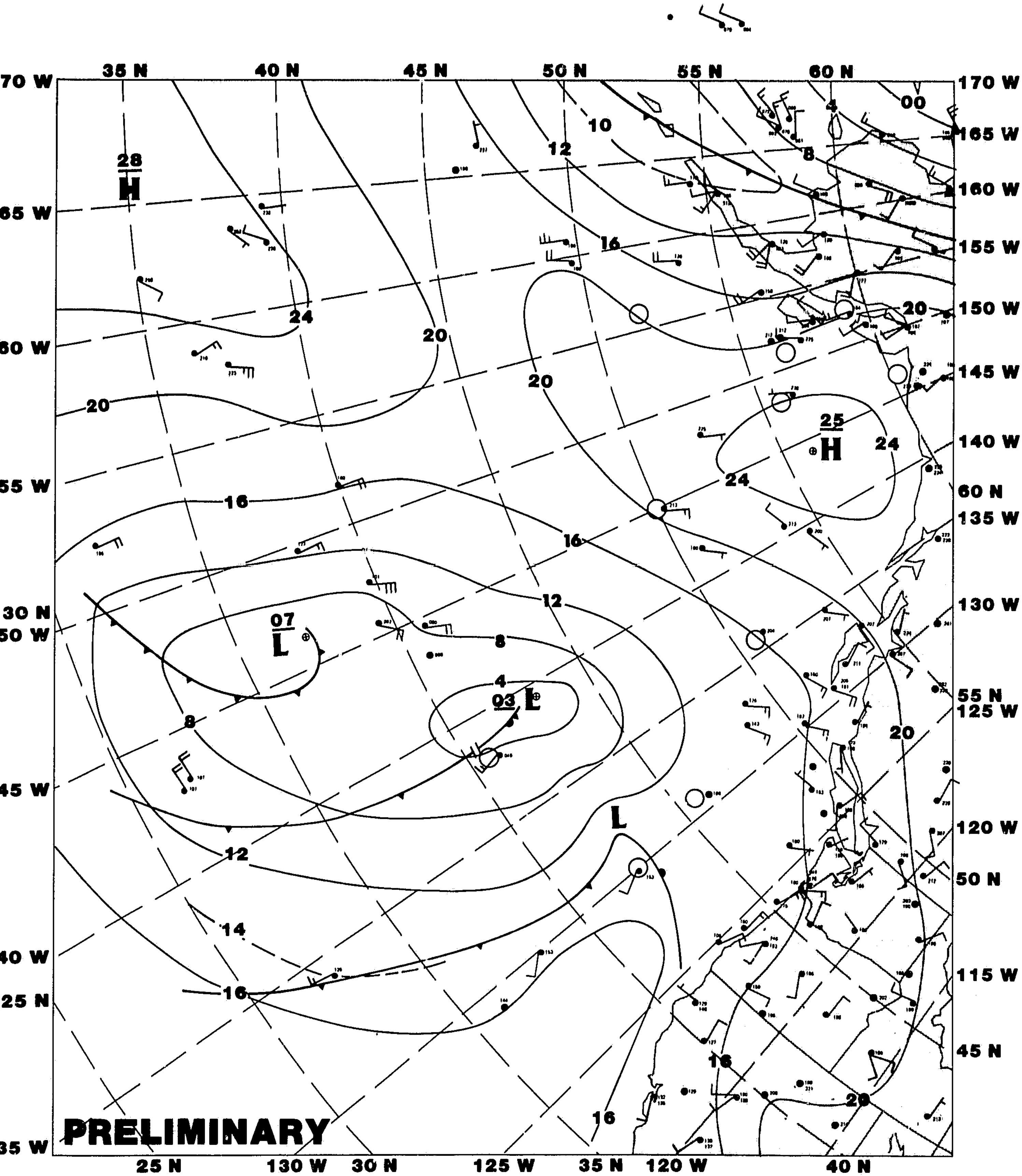
SEA LEVEL PRESSURE (SLP) AND OBSERVED WINDS (KNOTS)



18Z 19 SEPT 1978

REV 1212

SEA LEVEL PRESSURE (SLP) AND OBSERVED WINDS (KNOTS)



09Z 25 SEPT 1978 REV 1292,1293

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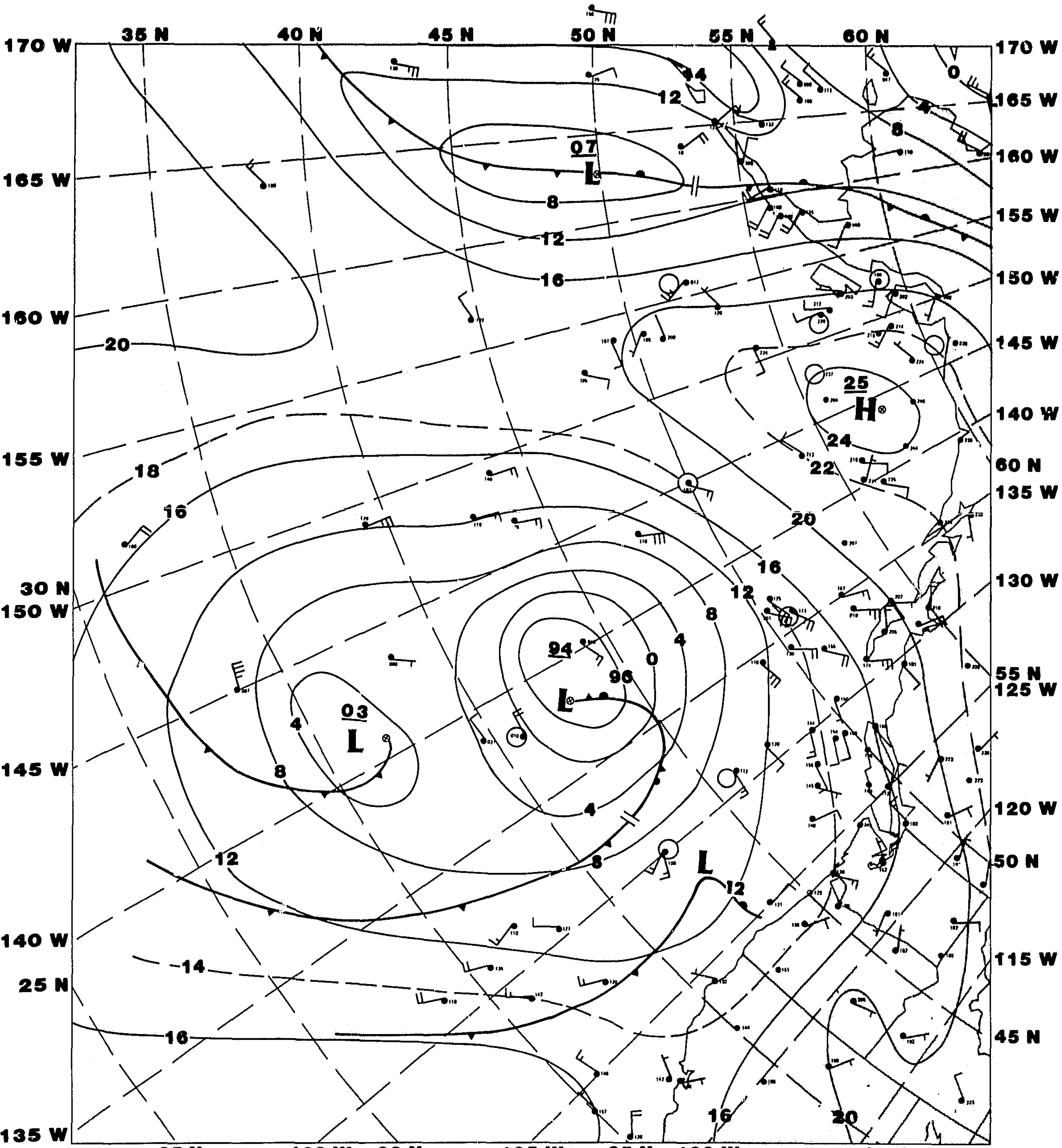
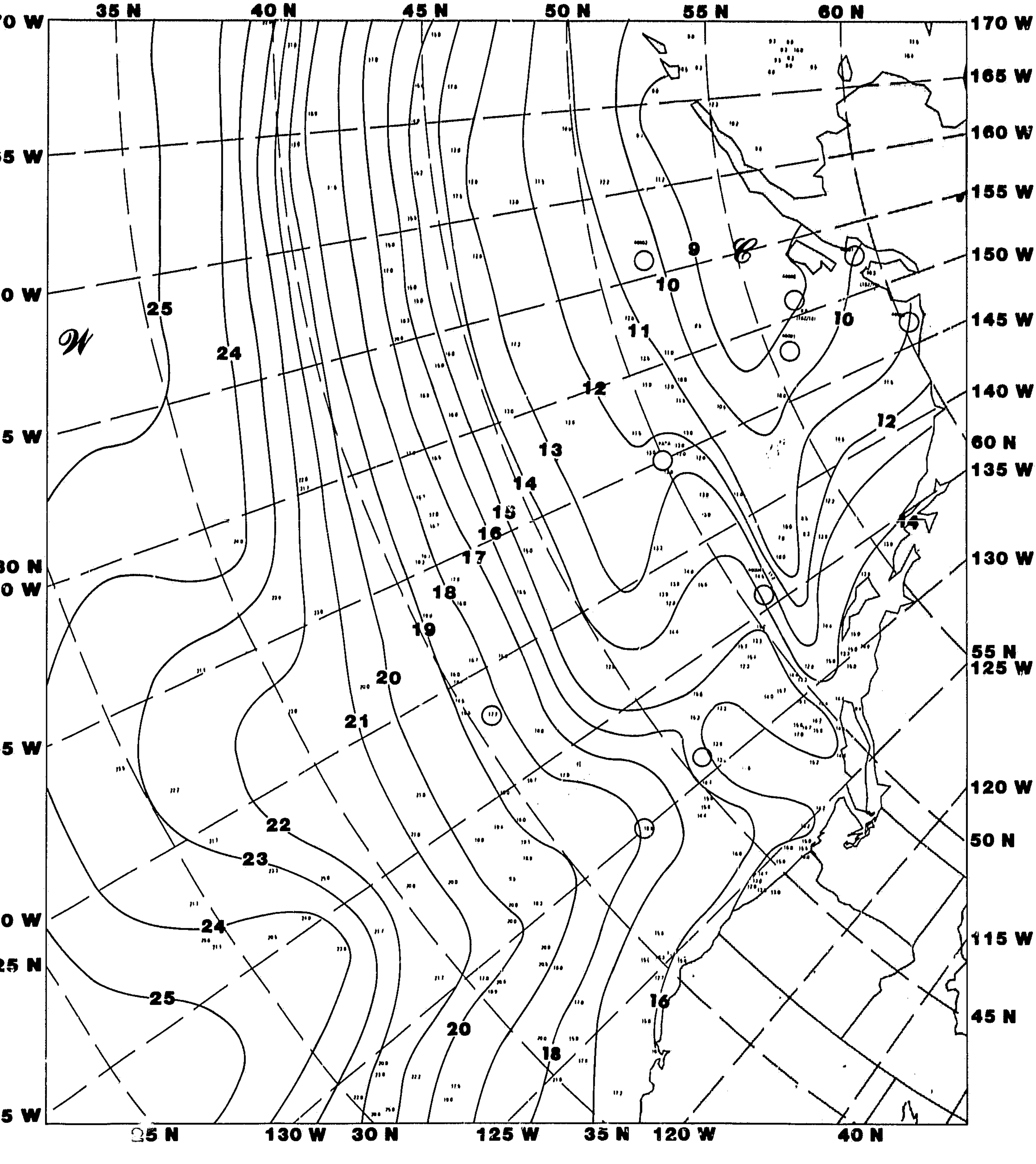


18Z 25 SEPT 1978

REV 1298

SECTION A-3
SEA SURFACE TEMPERATURE

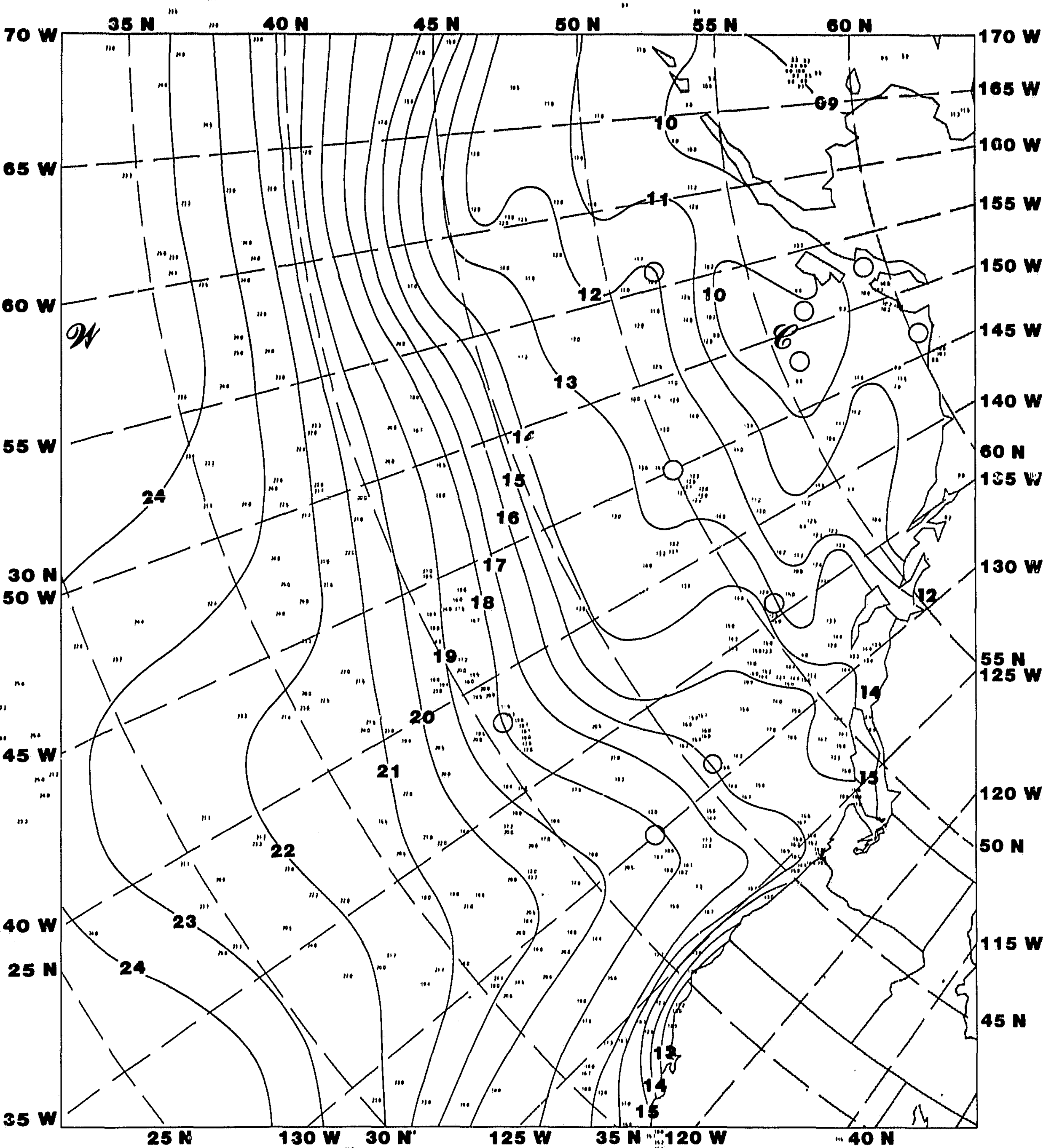
SEA SURFACE TEMPERATURE (SST, °C) ANALYSIS



13, 14, 15 SEPT 1978

REV 1134,1135,1140

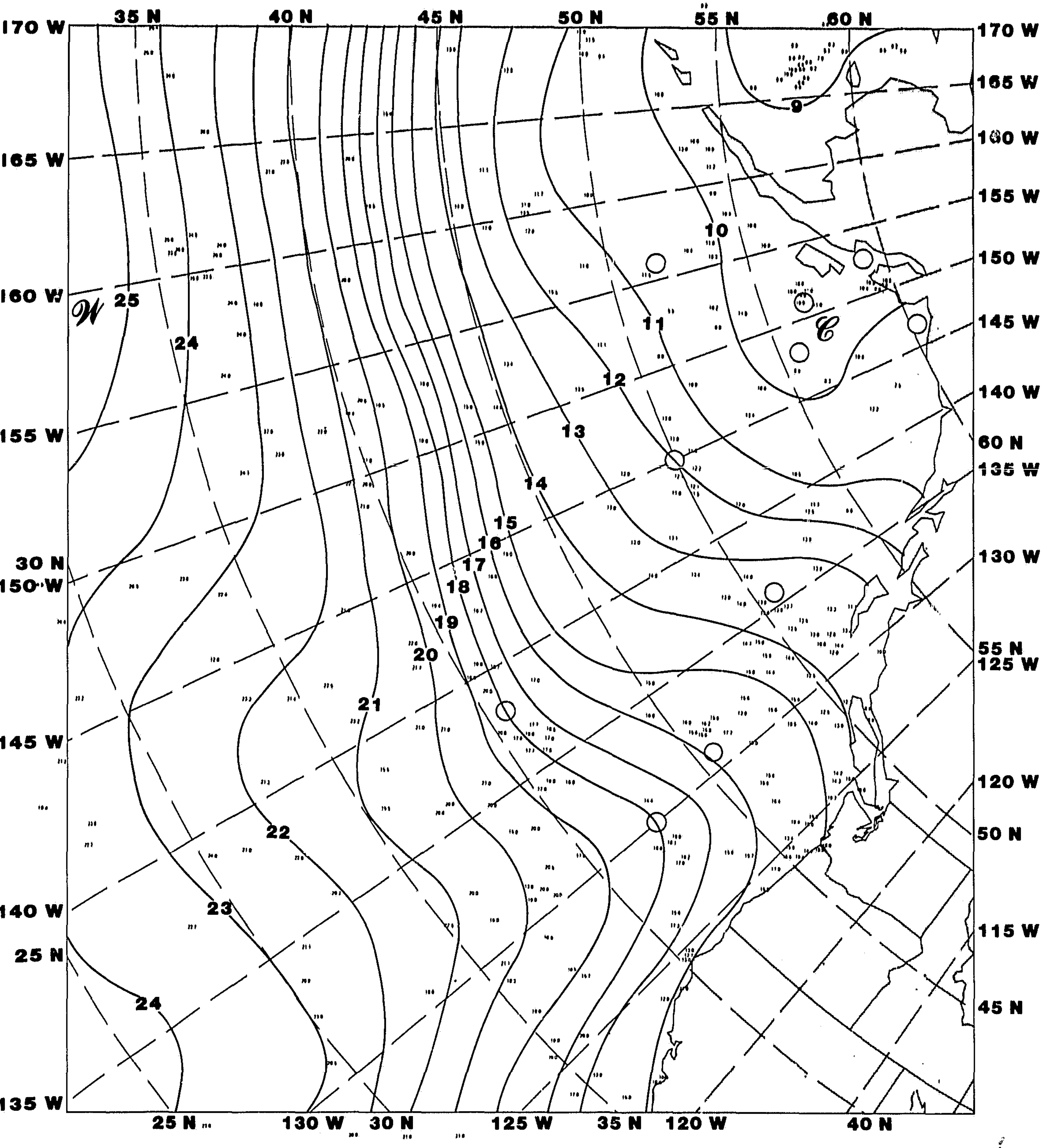
SEA SURFACE TEMPERATURE (SST, °C) ANALYSIS



15, 16, 17, 18 SEPT 1978

REV 1163,1164,1169, 1177,1178,1183

SEA SURFACE TEMPERATURE
(SST, °C) ANALYSIS



18, 19, 20 SEPT 1978 A-27 **REV 1206,1207,1212**

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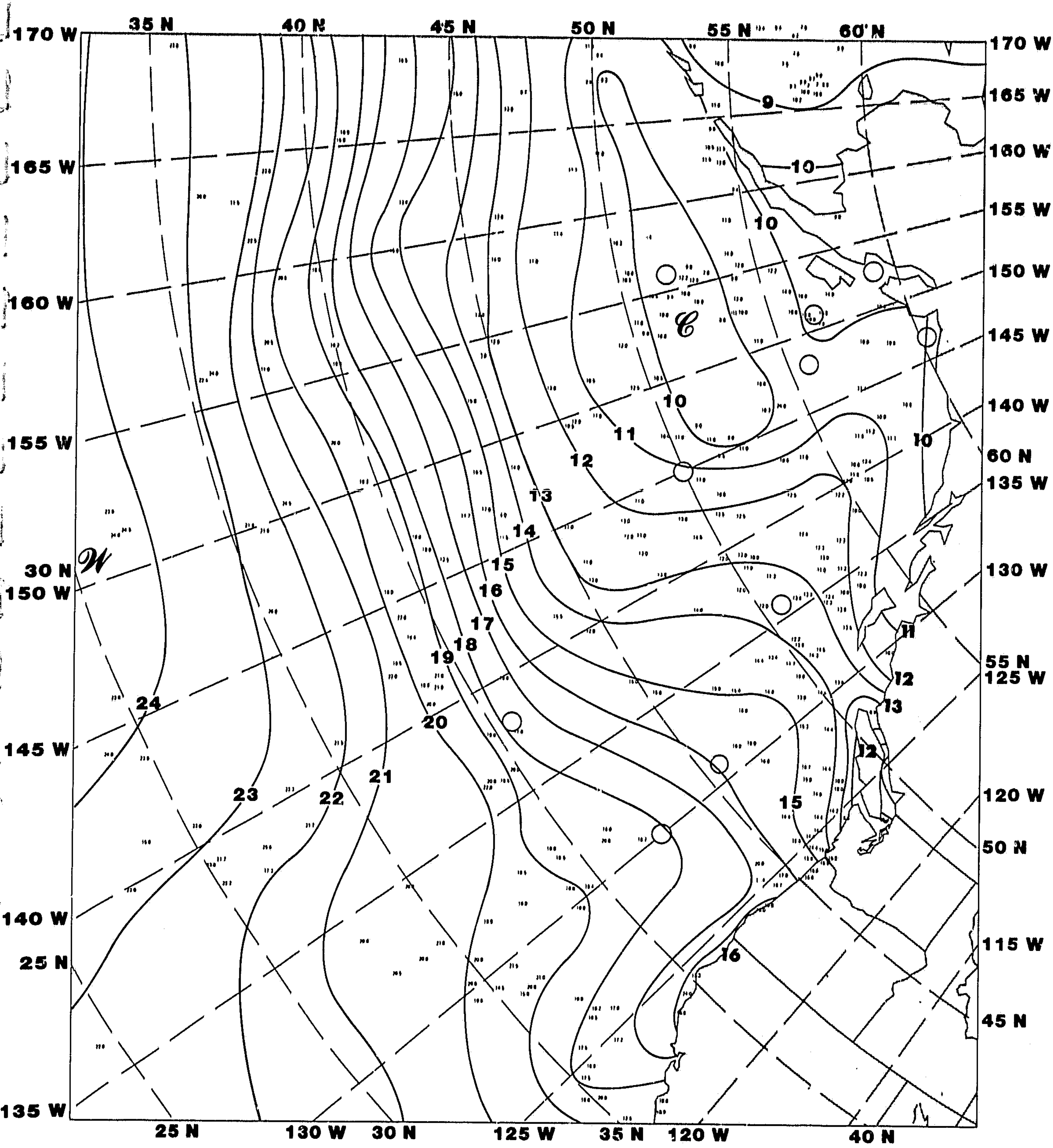

24, 25, 26 SEPT 1978 A-28 **REV 1292,1293,1298**

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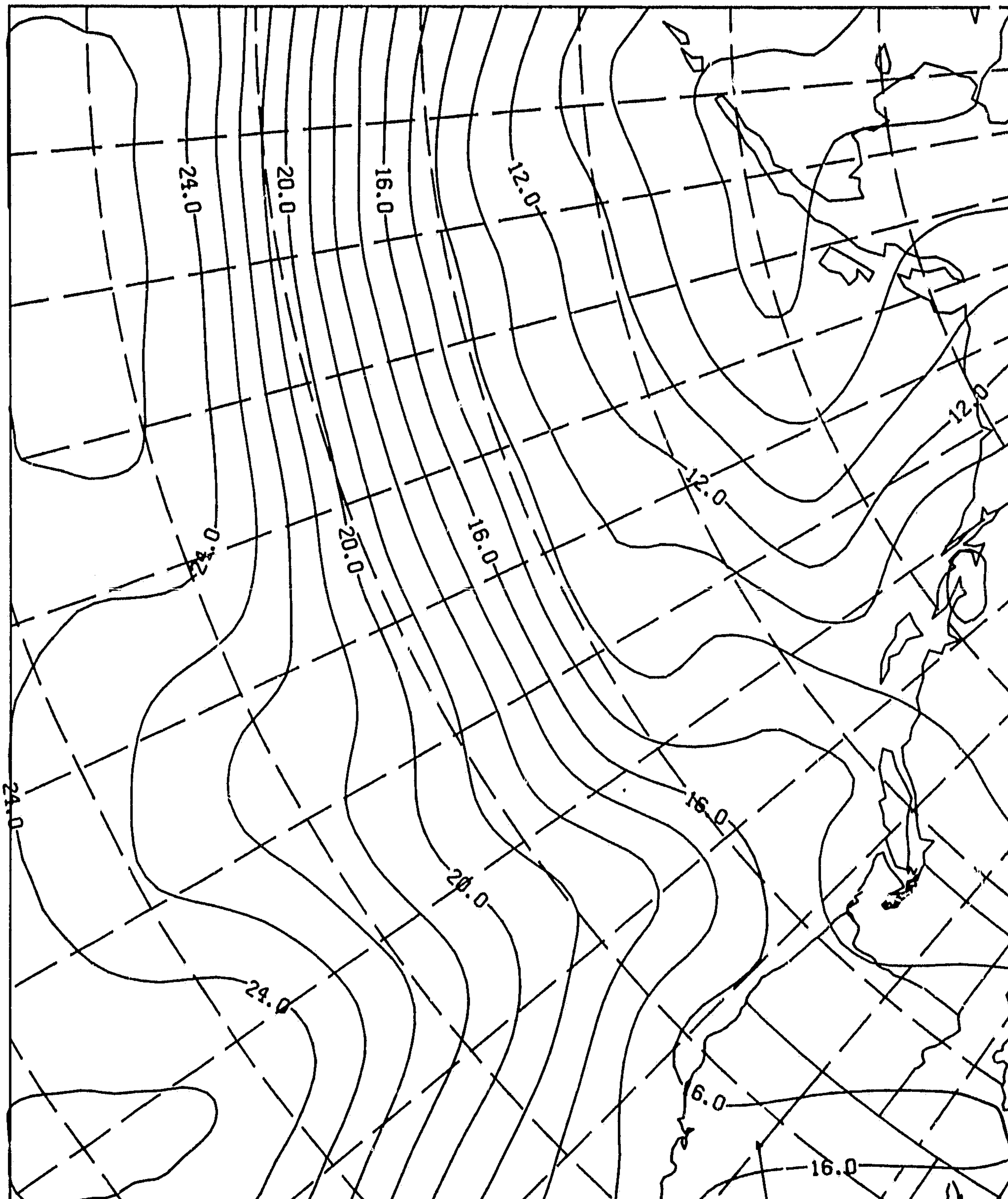

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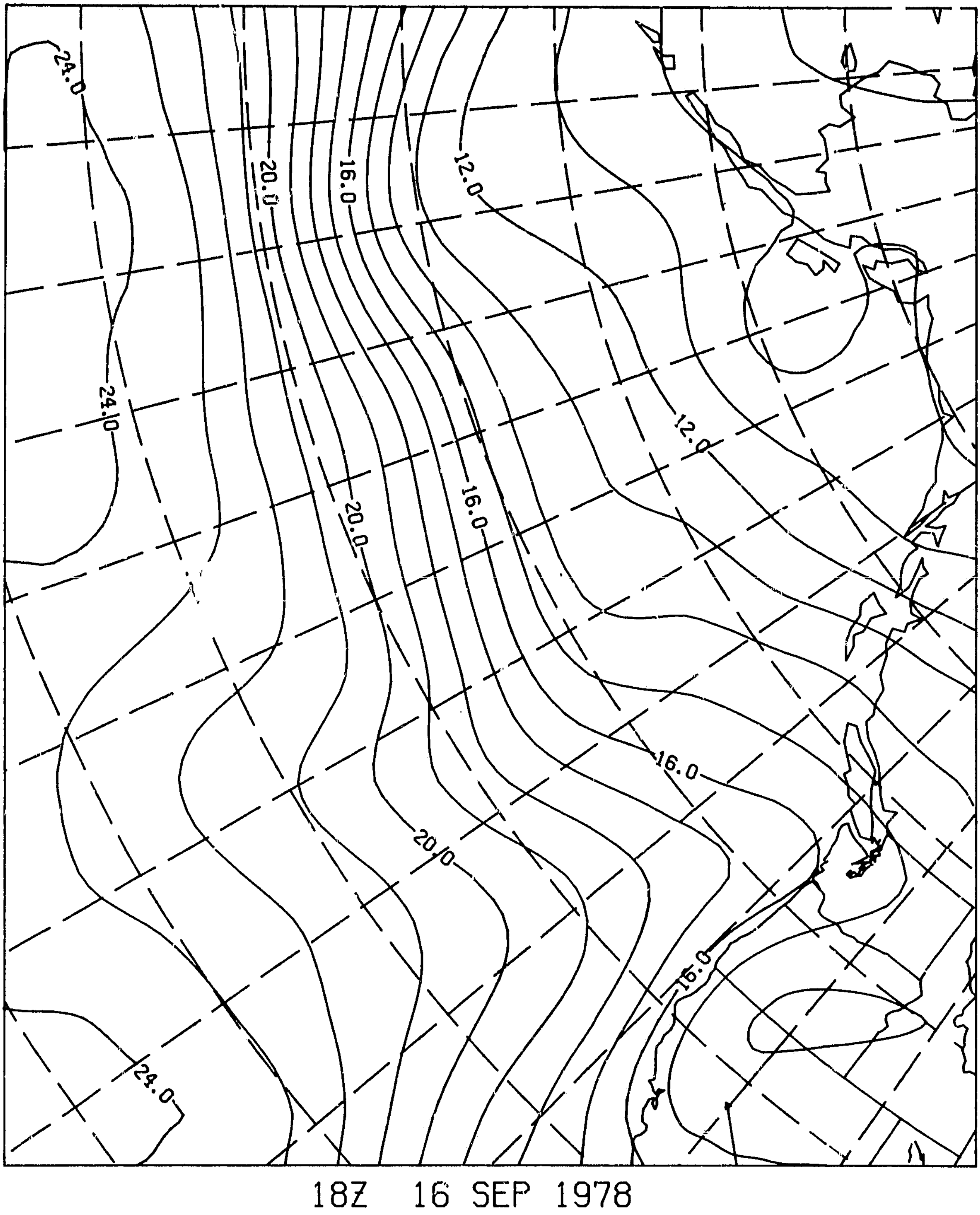

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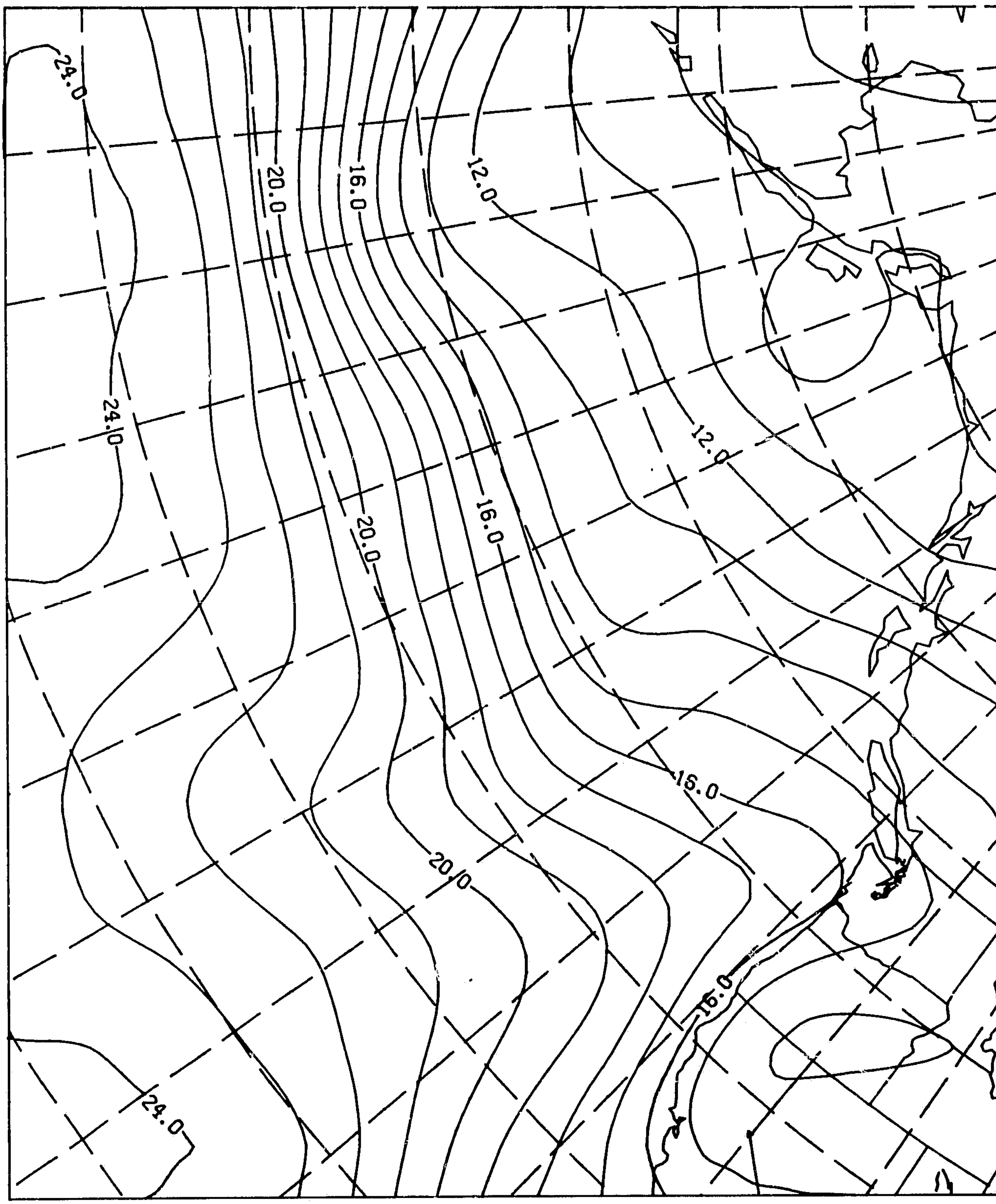

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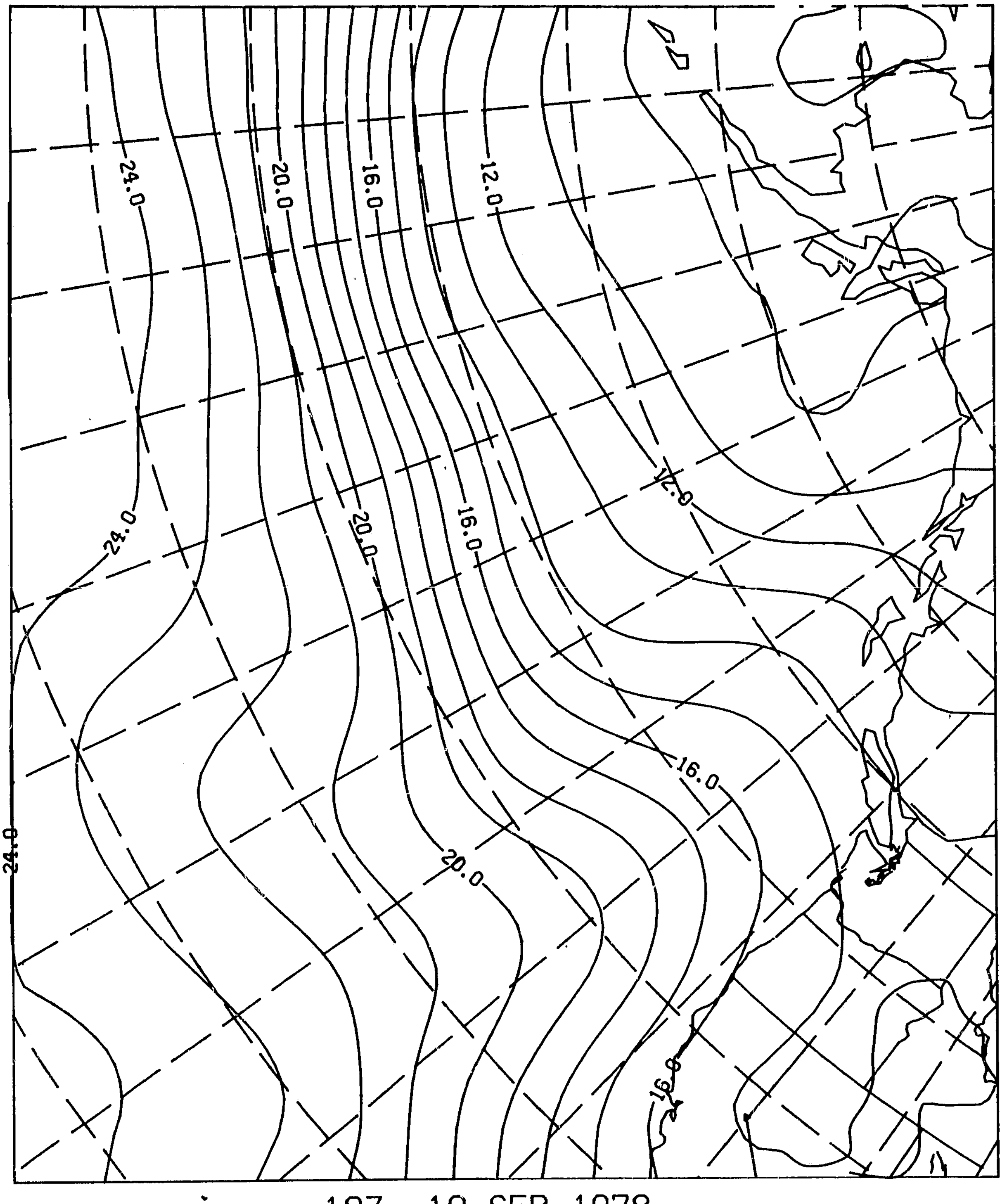

18Z 19 SEP 1978

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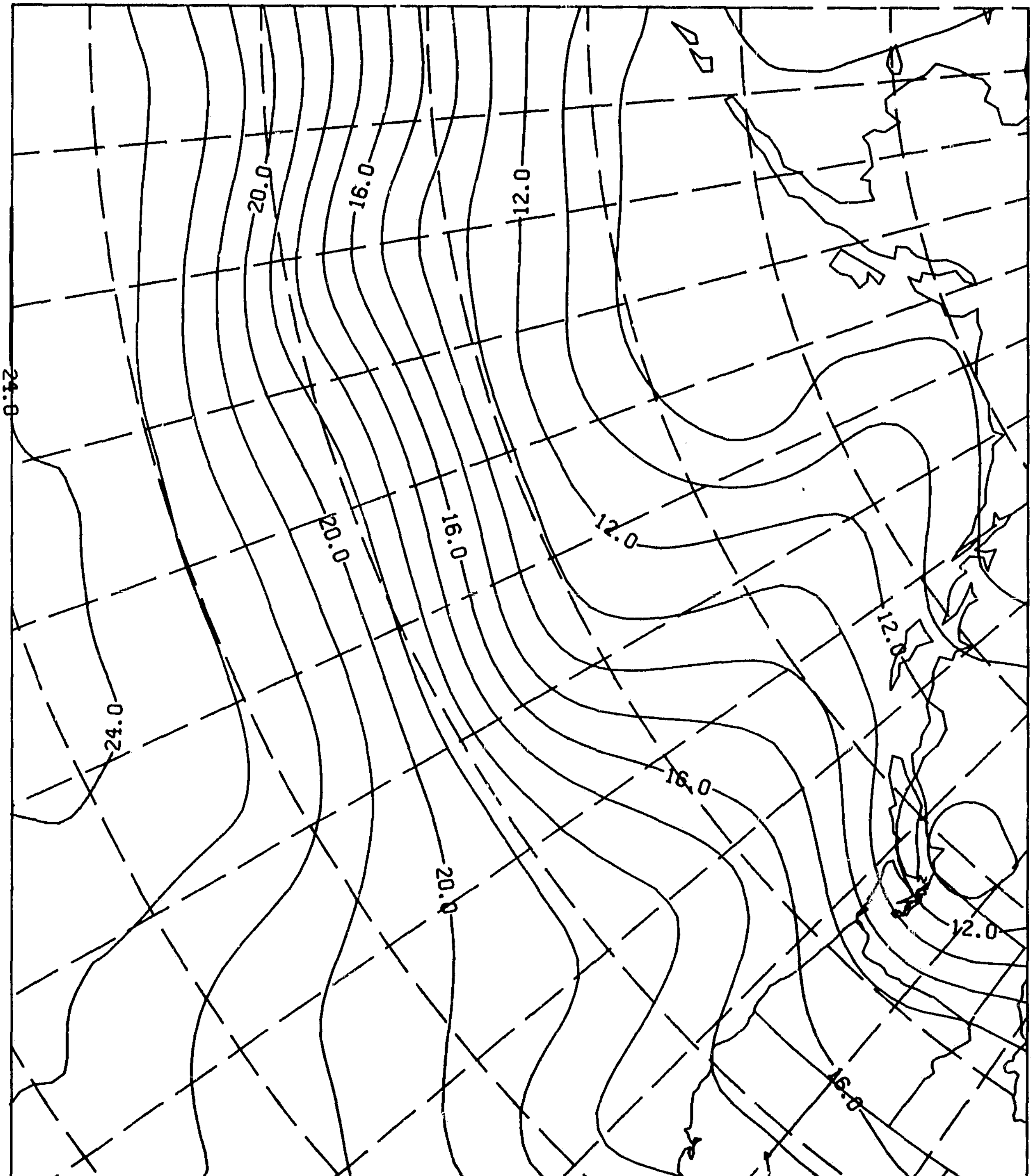

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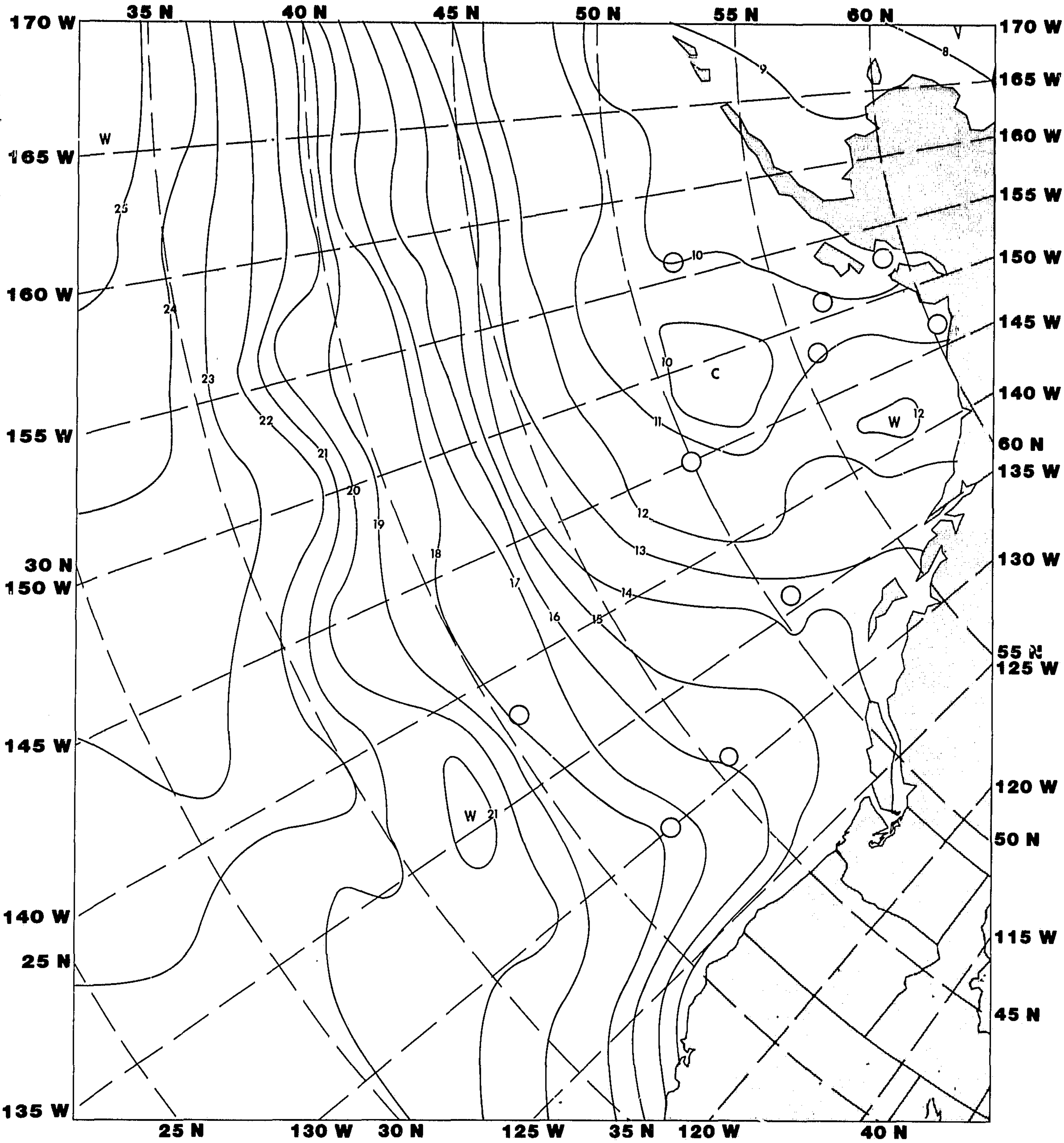
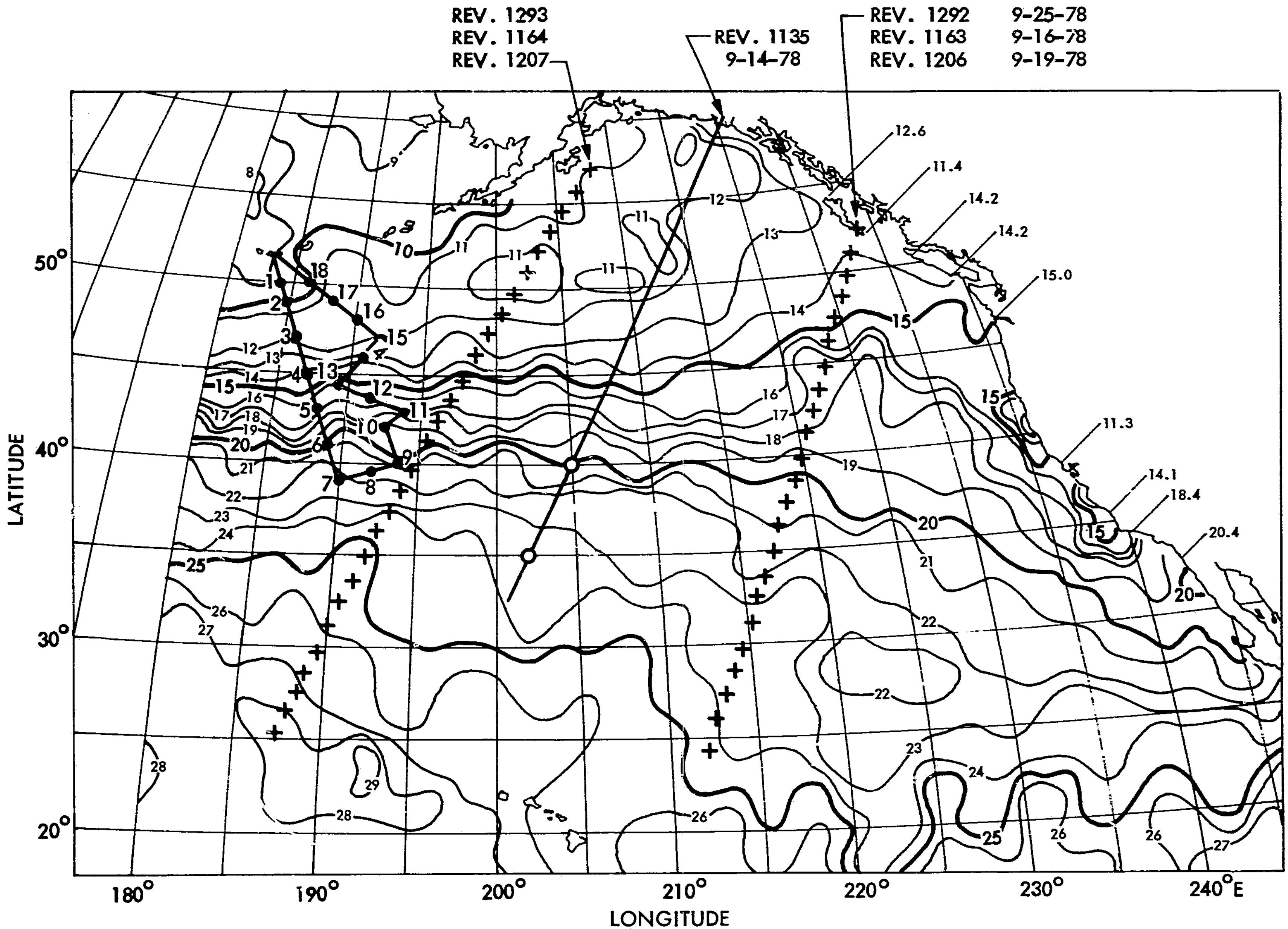
SEA SURFACE TEMPERATURE, °C

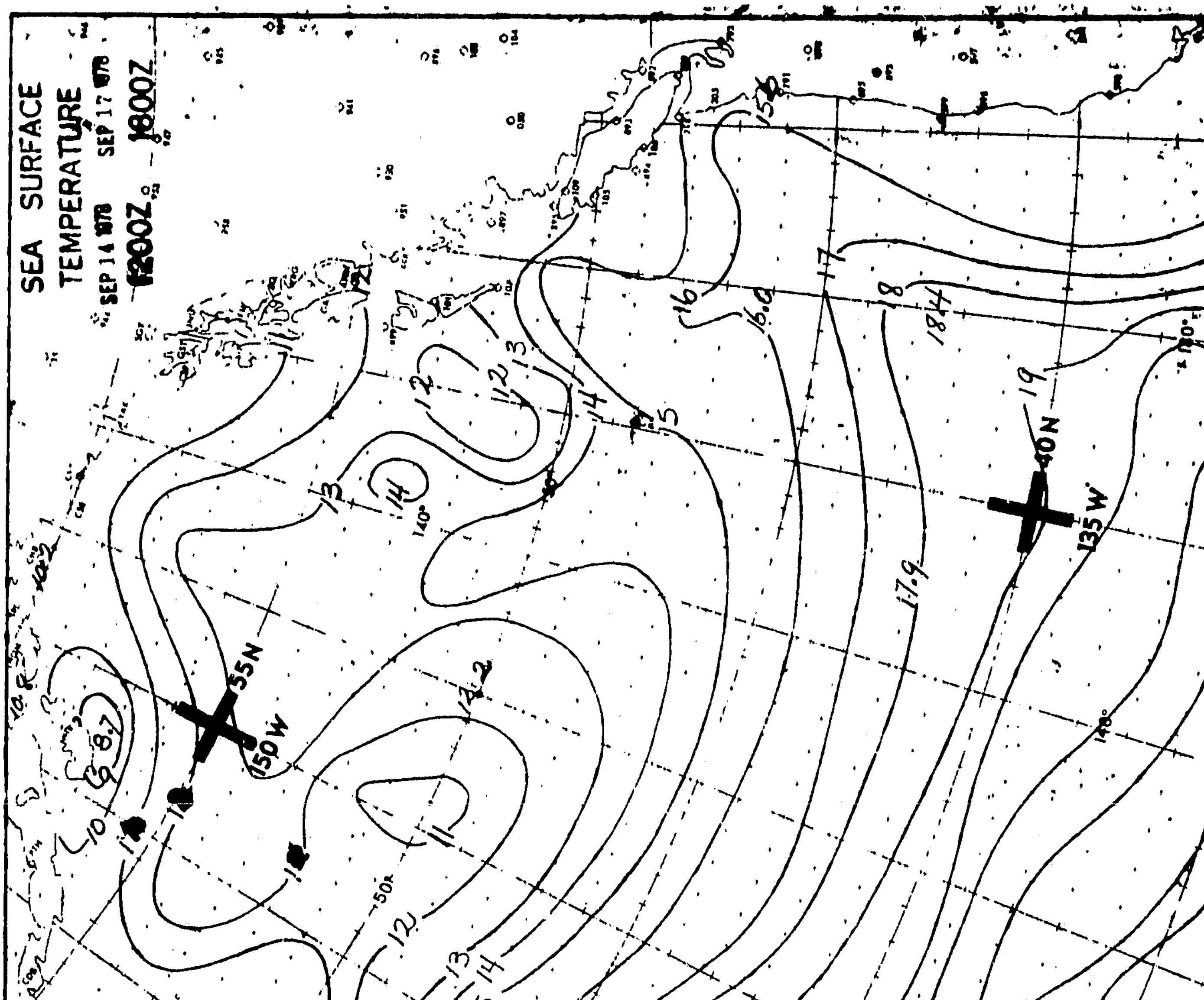


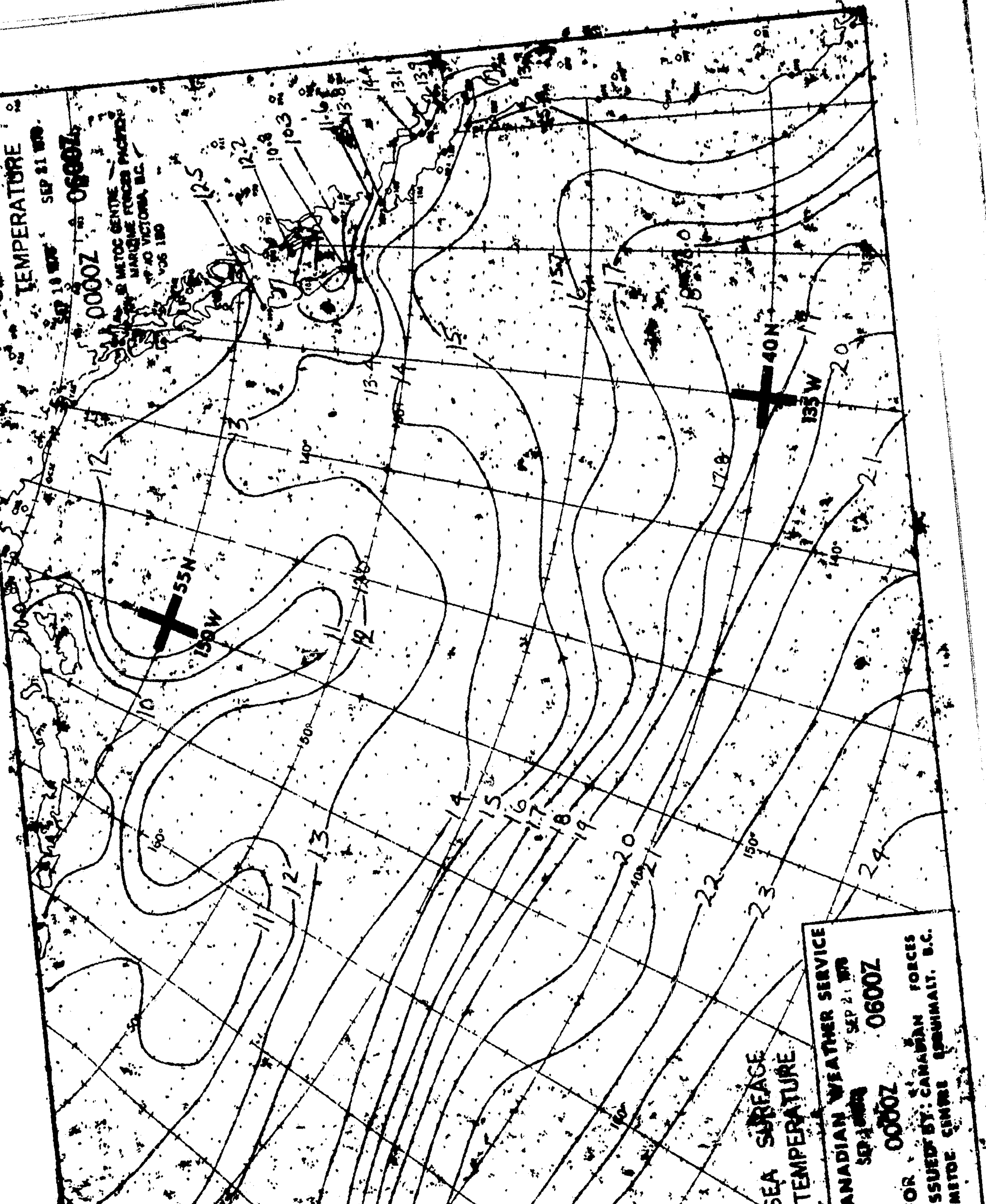
25 SEPT 1978

(CARDONE)

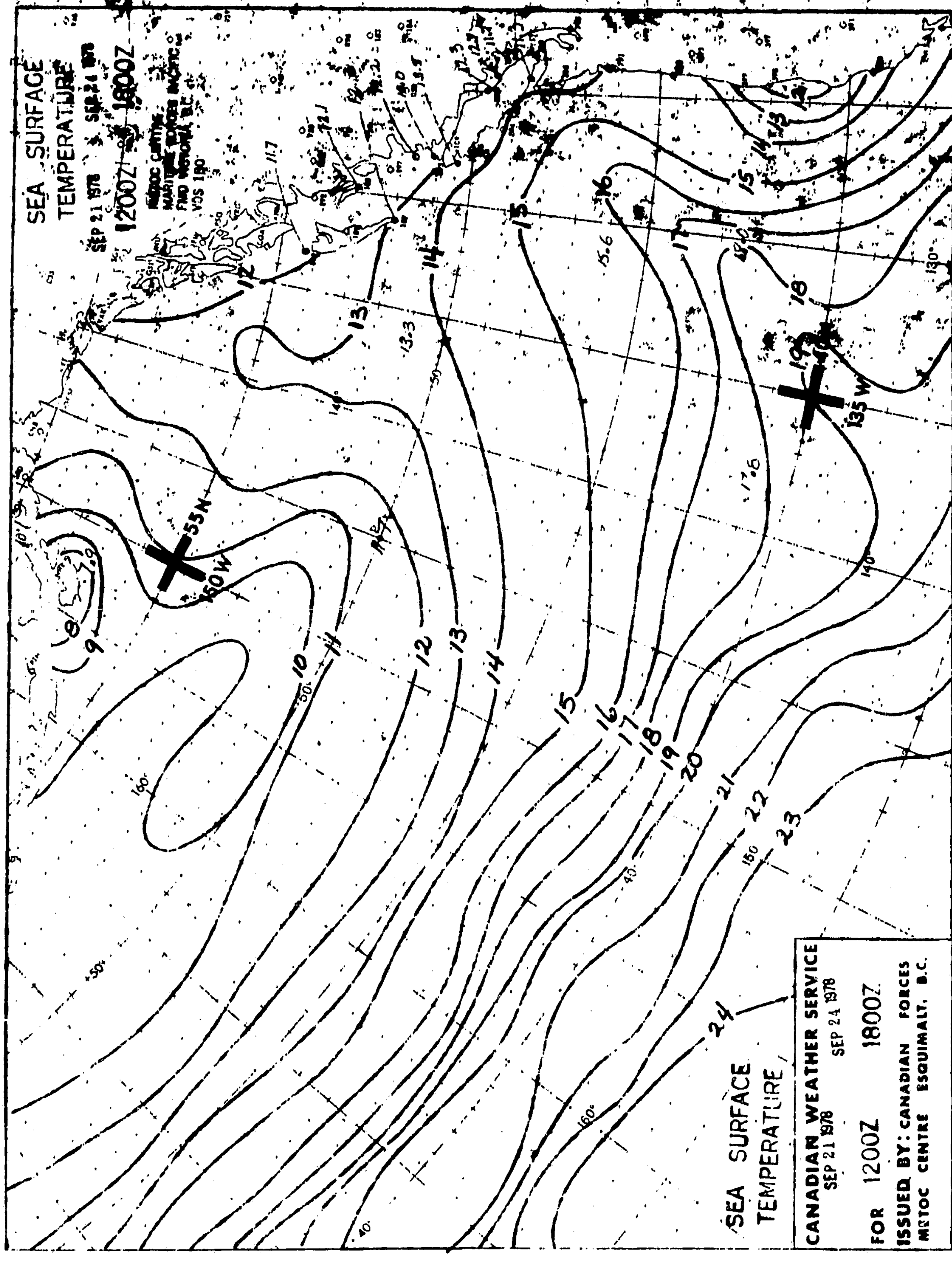


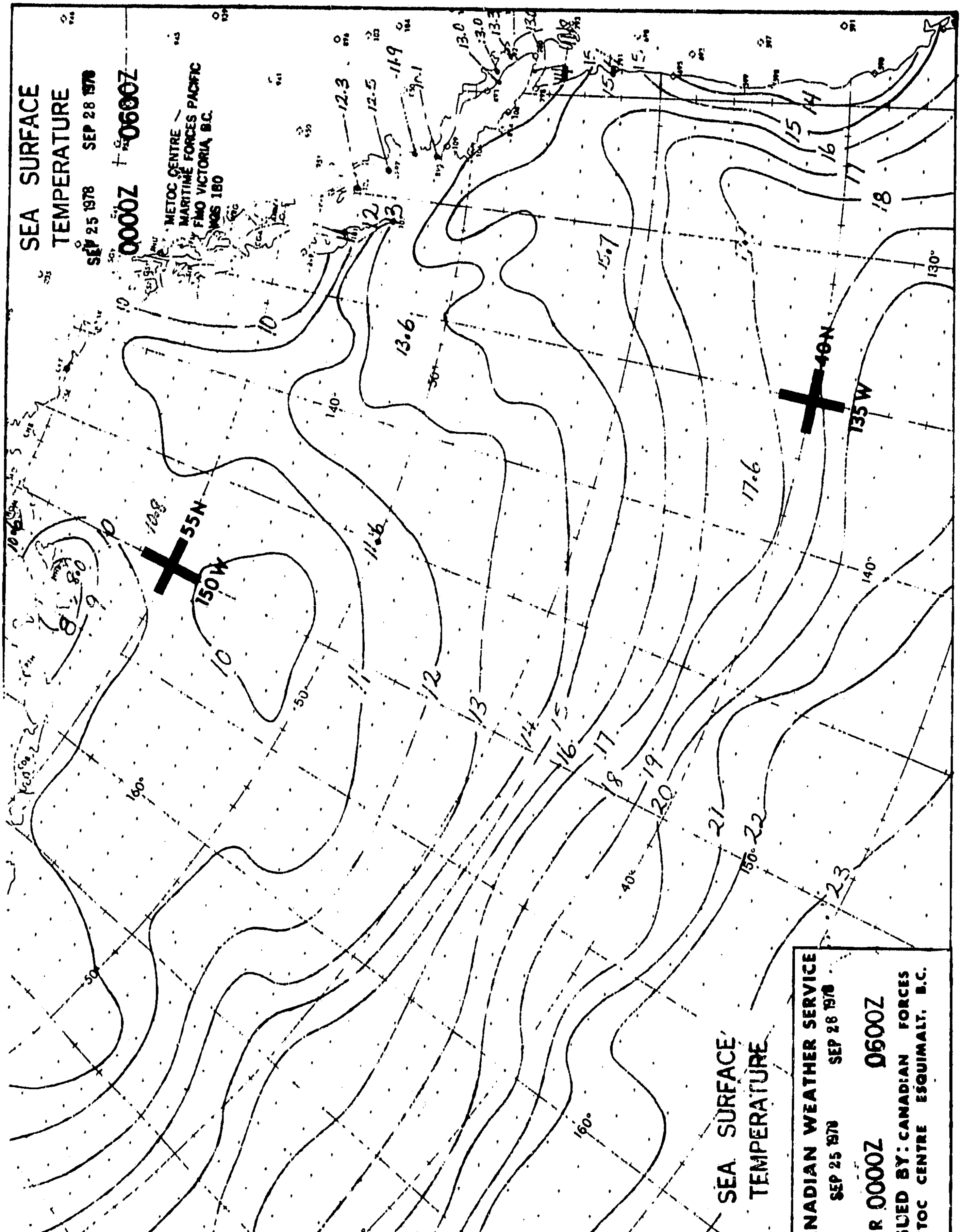
National Marine Fisheries Service (NMFS) analysis of sea surface temperature for September 1978. This Figure is also Fig. 8-6 in SMMR Section 8.


SEA SURFACE TEMPERATURE
SEP 14 1978 SEP 17 1978
1200Z 1800Z
55N
150W
40N
135W
CANADIAN WEATHER SERVICE
SEP 14 1978 SEP 17 1978
FOR 1200Z 1800Z
ISSUED BY: CANADIAN FORCES
METOC CENTRE ESQUIMALT, B.C.



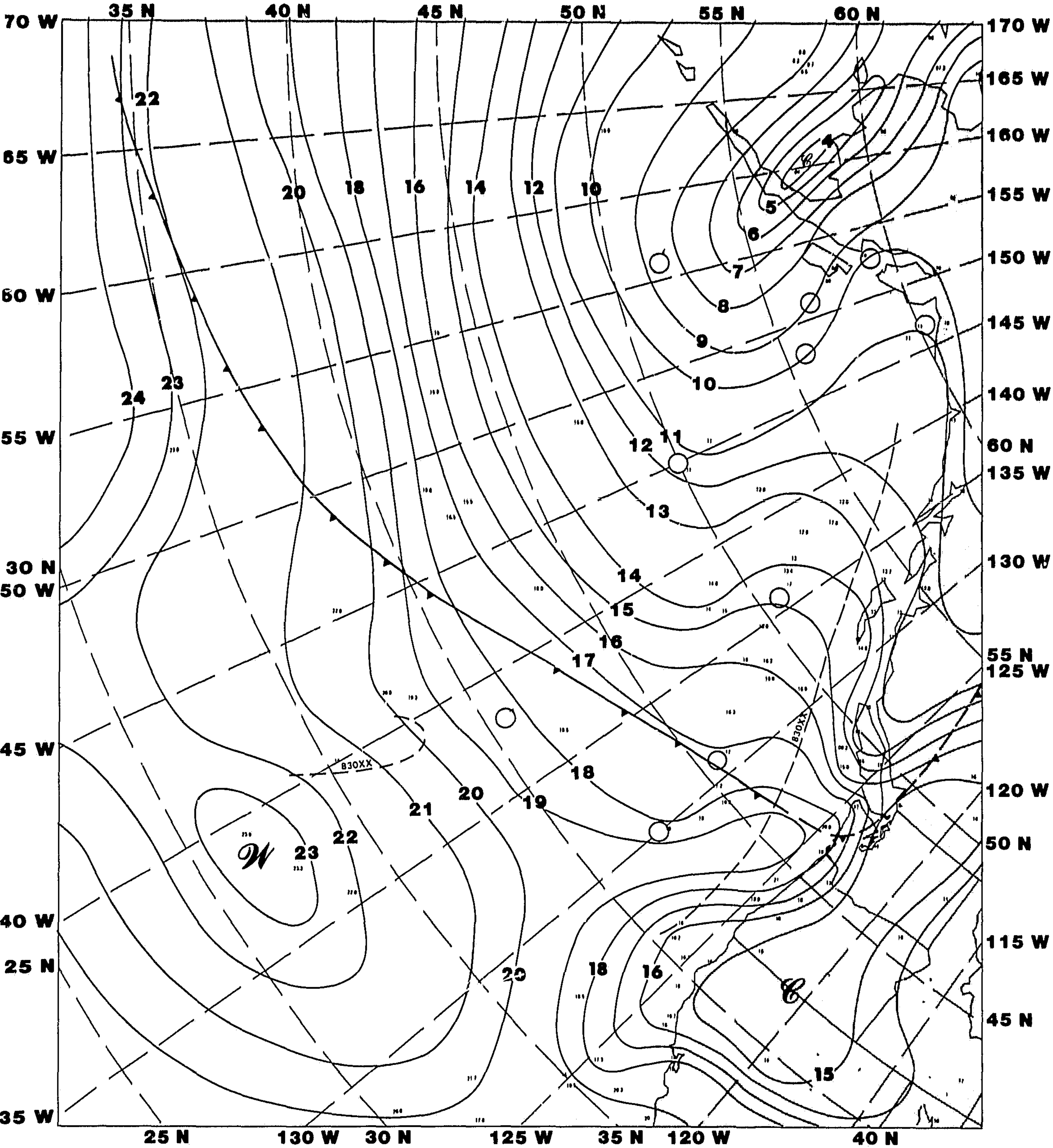
SEA SURFACE TEMPERATURE
0000Z
0600Z
METOC CENTRE
VICTORIA, B.C.
55N
150W
40N
135W
CANADIAN WEATHER SERVICE
FOR
ISSUED BY: CANADIAN FORCES
METOC CENTRE ESQUIMALT, B.C.


SEA SURFACE
TEMPERATURE
SEP 21 1978 & SEP 24 1978
1200Z & 1800Z
55N
160W
135 W
SEA SURFACE
TEMPERATURE
CANADIAN WEATHER SERVICE
SEP 21 1978 SEP 24 1978
FOR 1200Z 1800Z
ISSUED BY: CANADIAN FORCES
METOC CENTRE ESQUIMALT, B.C.


SEA SURFACE TEMPERATURE
SEP 25 1978 SEP 28 1978
0000Z 0600Z
METOC CENTRE — MARITIME FORCES PACIFIC FMO VICTORIA B.C. WQS 180
55N 150W
48N 135W
SEA SURFACE TEMPERATURE
CANADIAN WEATHER SERVICE
SEP 25 1978 SEP 28 1978
FOR 0000Z 0600Z
ISSUED BY: CANADIAN FORCES
METOC CENTRE ESQUIMALT, B.C.

SECTION A-4
SURFACE AIR TEMPERATURE AND AIR-SEA TEMPERATURE DIFFERENCE

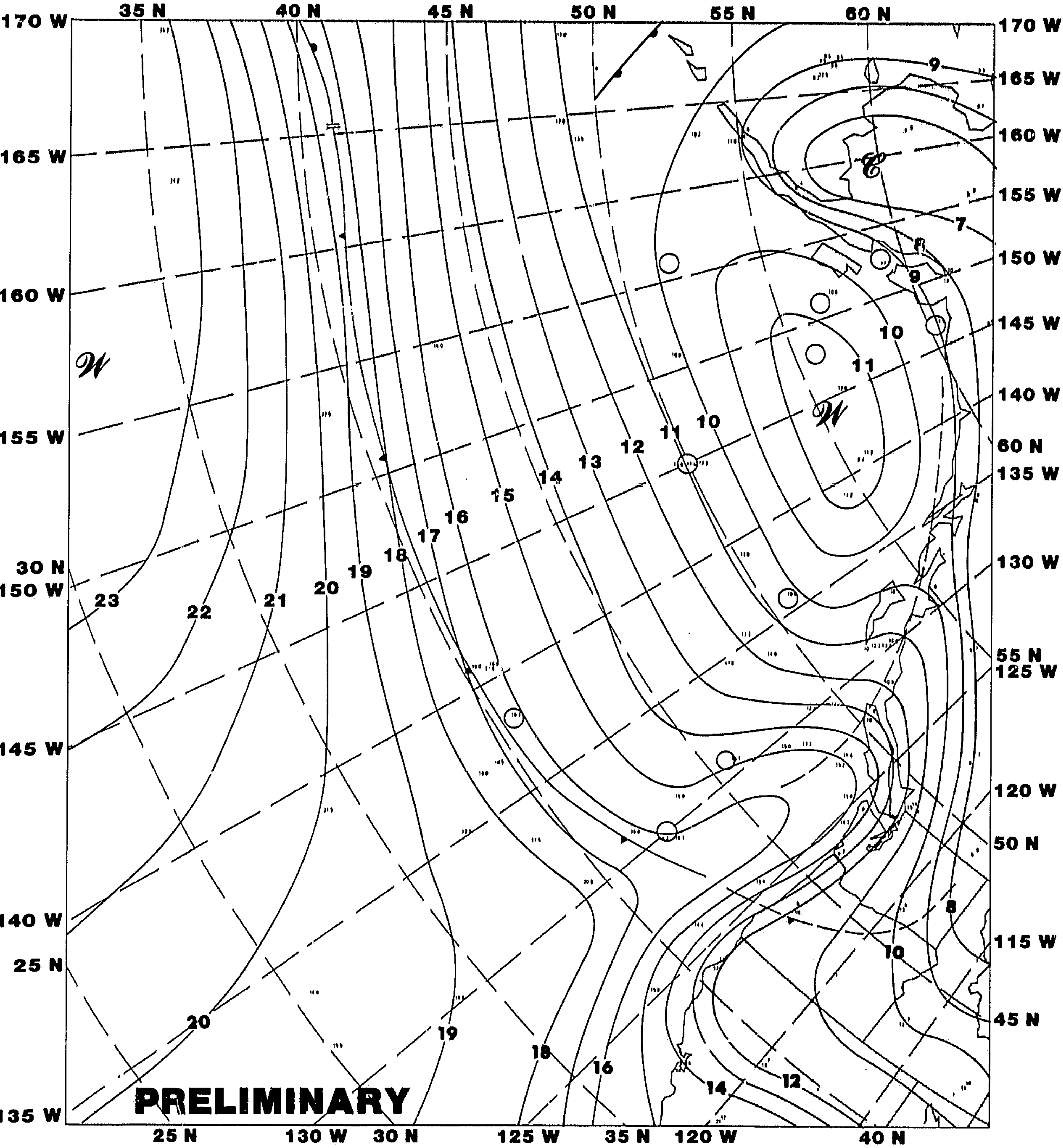
SURFACE AIR TEMPERATURE (SAT, °C) ANALYSIS



18Z 14 SEPT 1978

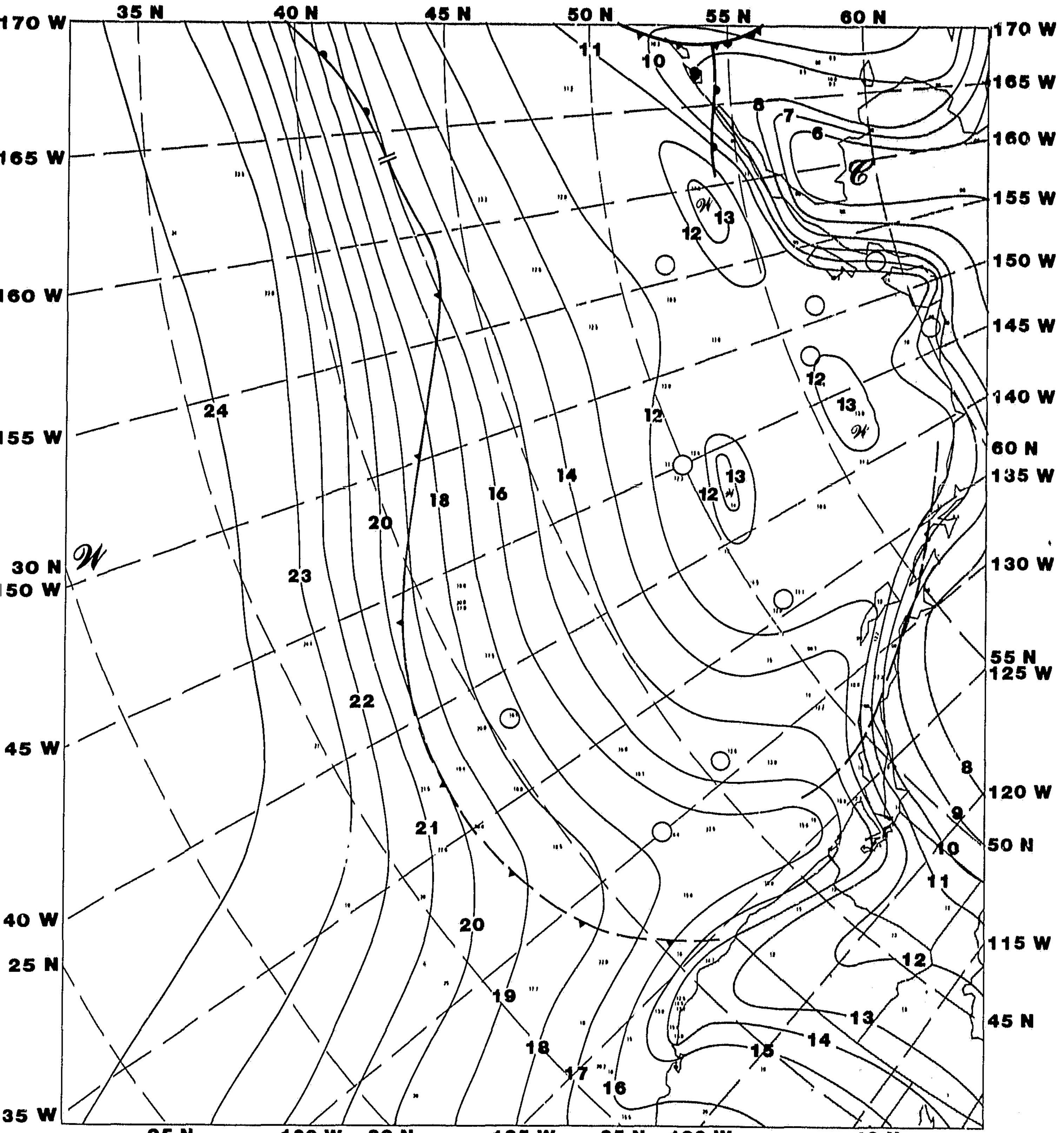
REV 1140

SURFACE AIR TEMPERATURE
(SAT, °C) ANALYSIS



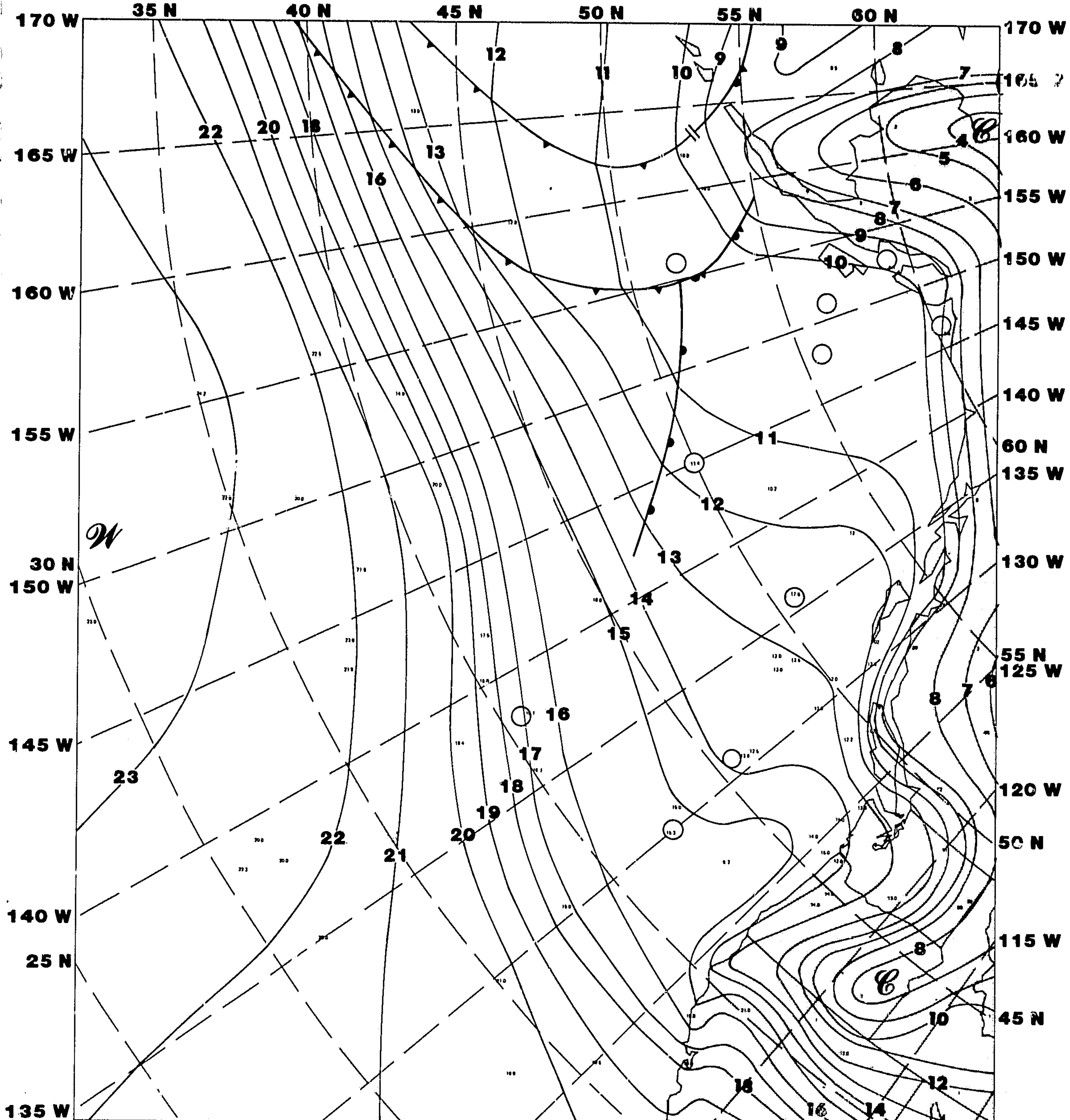
09Z 16 SEPT 1978 A-42 **REV 1163,1164**

SURFACE AIR TEMPERATURE
(SAT, °C) ANALYSIS



18Z 16 SEPT 1978 A-43 **REV 1169**

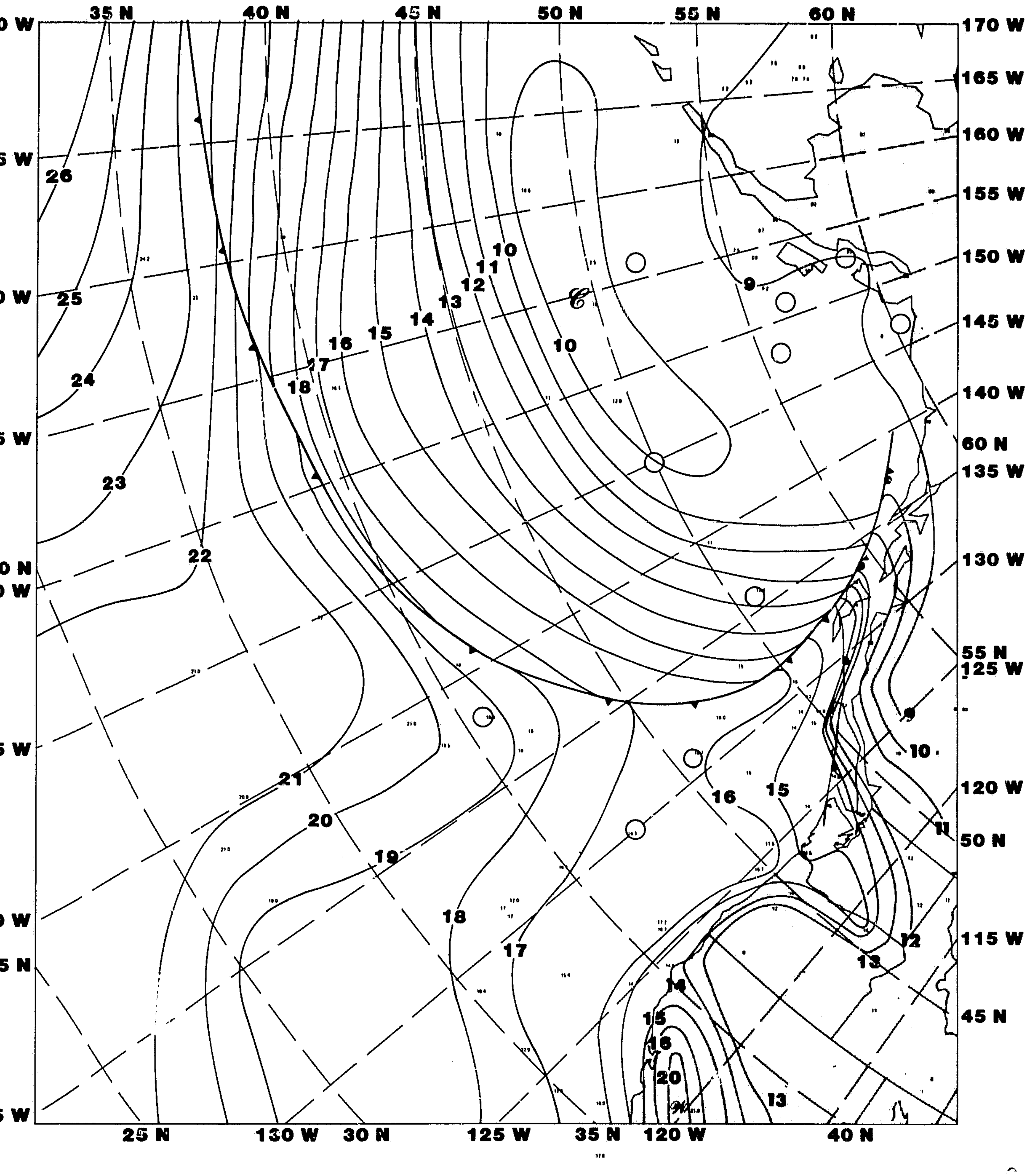
SURFACE AIR TEMPERATURE (SAT, °C) ANALYSIS



18Z 17 SEPT 1978

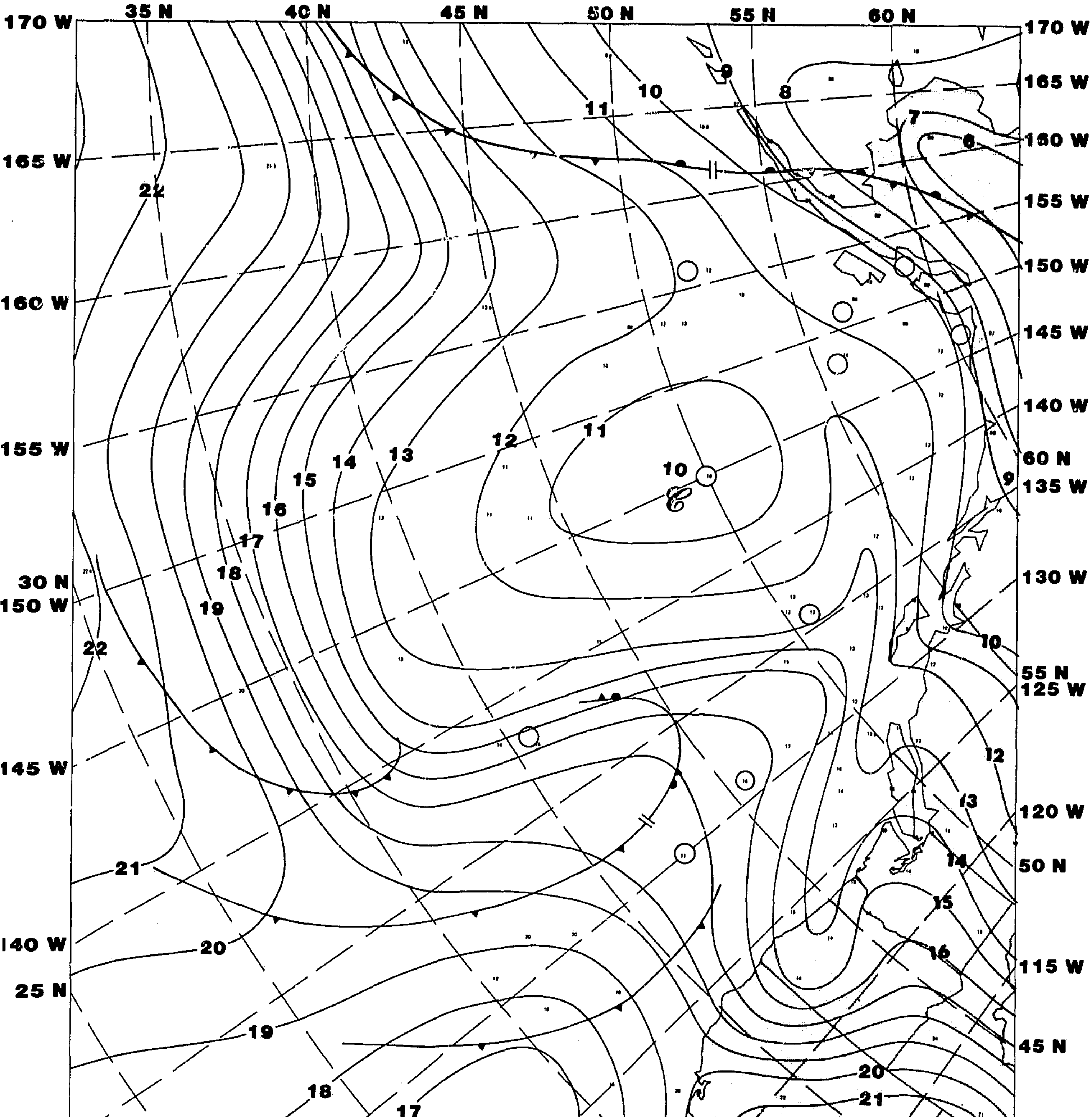
REV 1183

SURFACE AIR TEMPERATURE
(SAT, °C) ANALYSIS



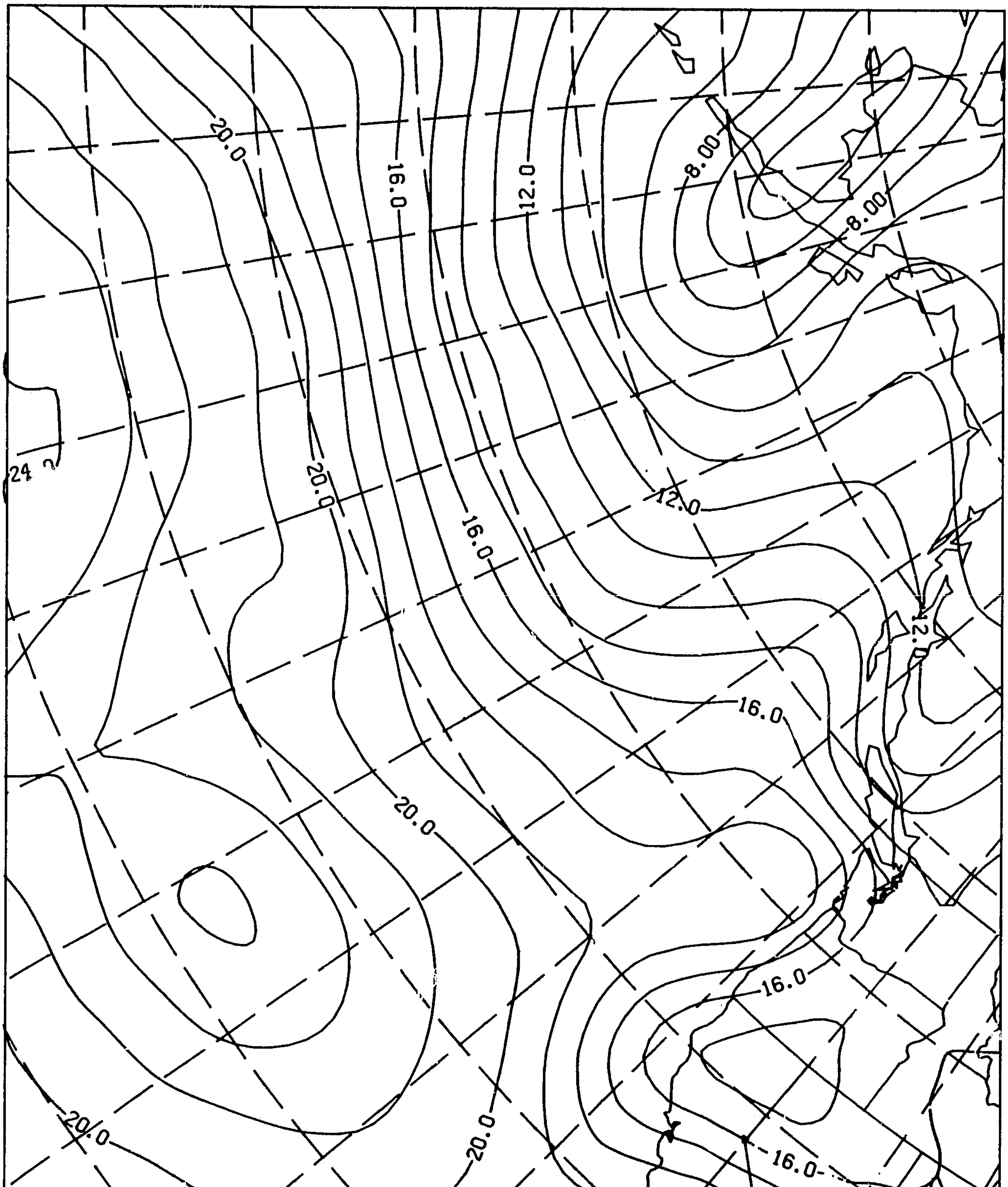
18Z 19 SEPT 1978 **REV 1212**

SURFACE AIR TEMPERATURE (SAT, °C) ANALYSIS



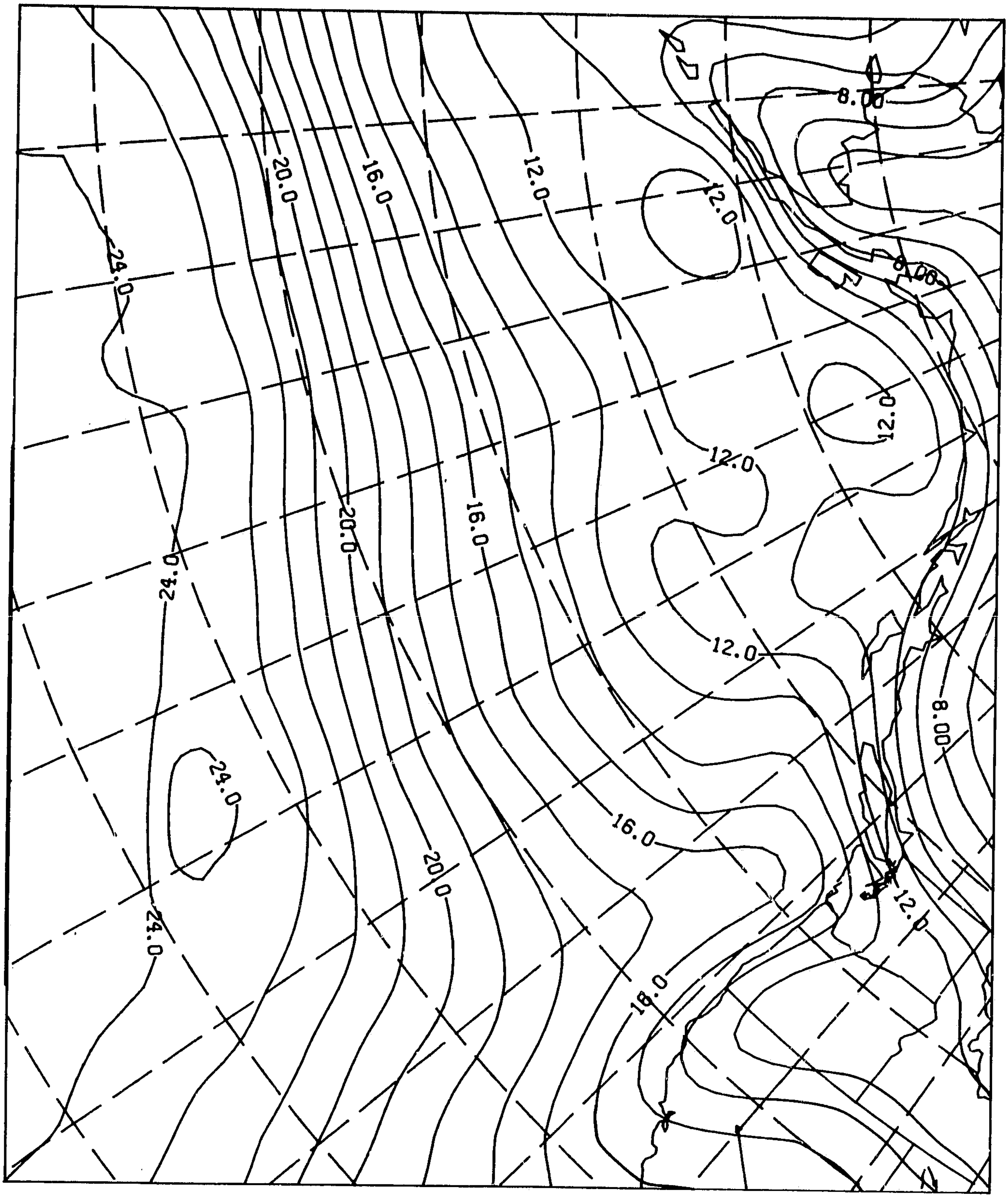
18Z 25 SEPT 1978 REV 1298

ØBSERVED SAT



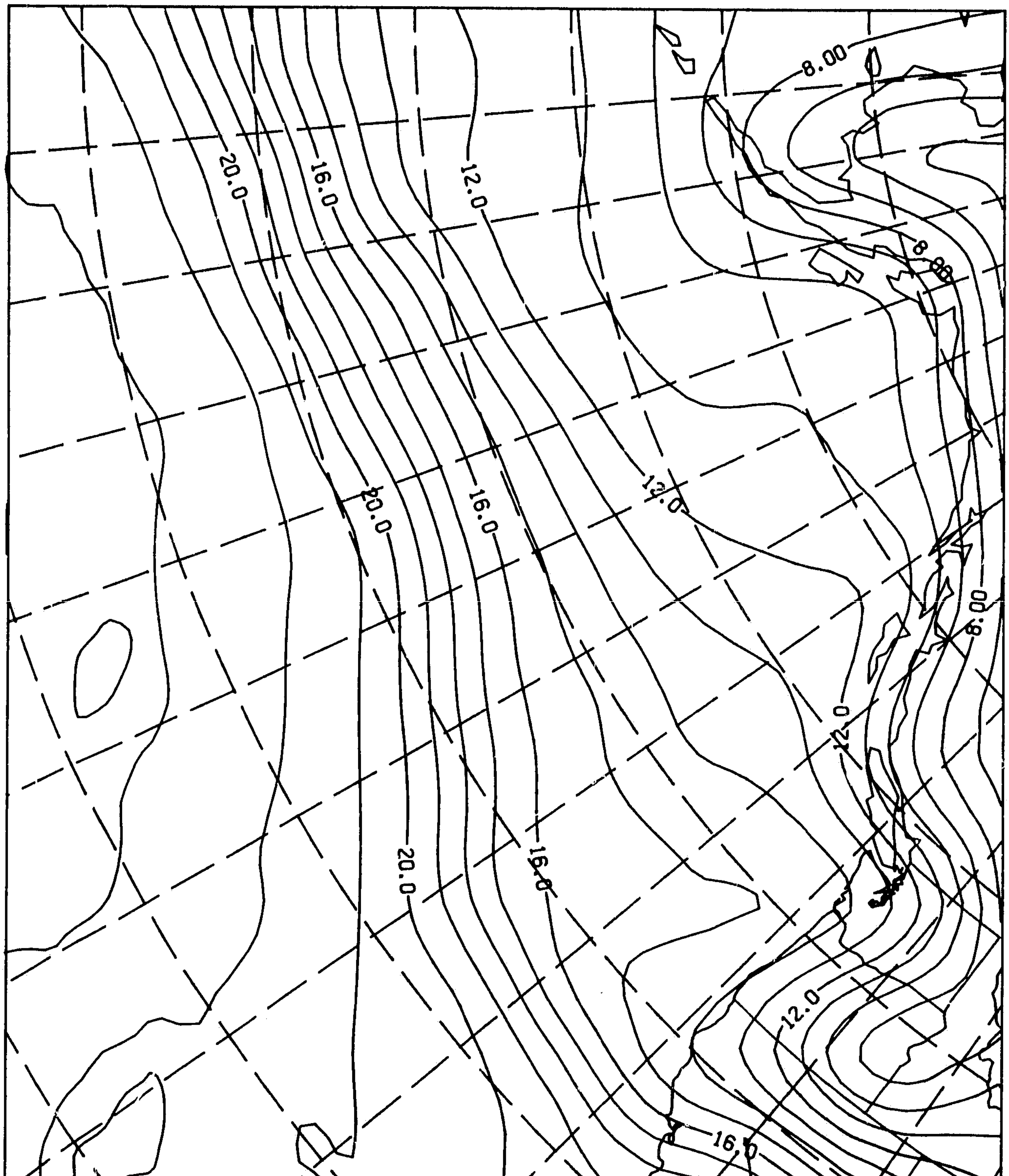
18Z 14 SEP 1978

ØBSERVED SAT



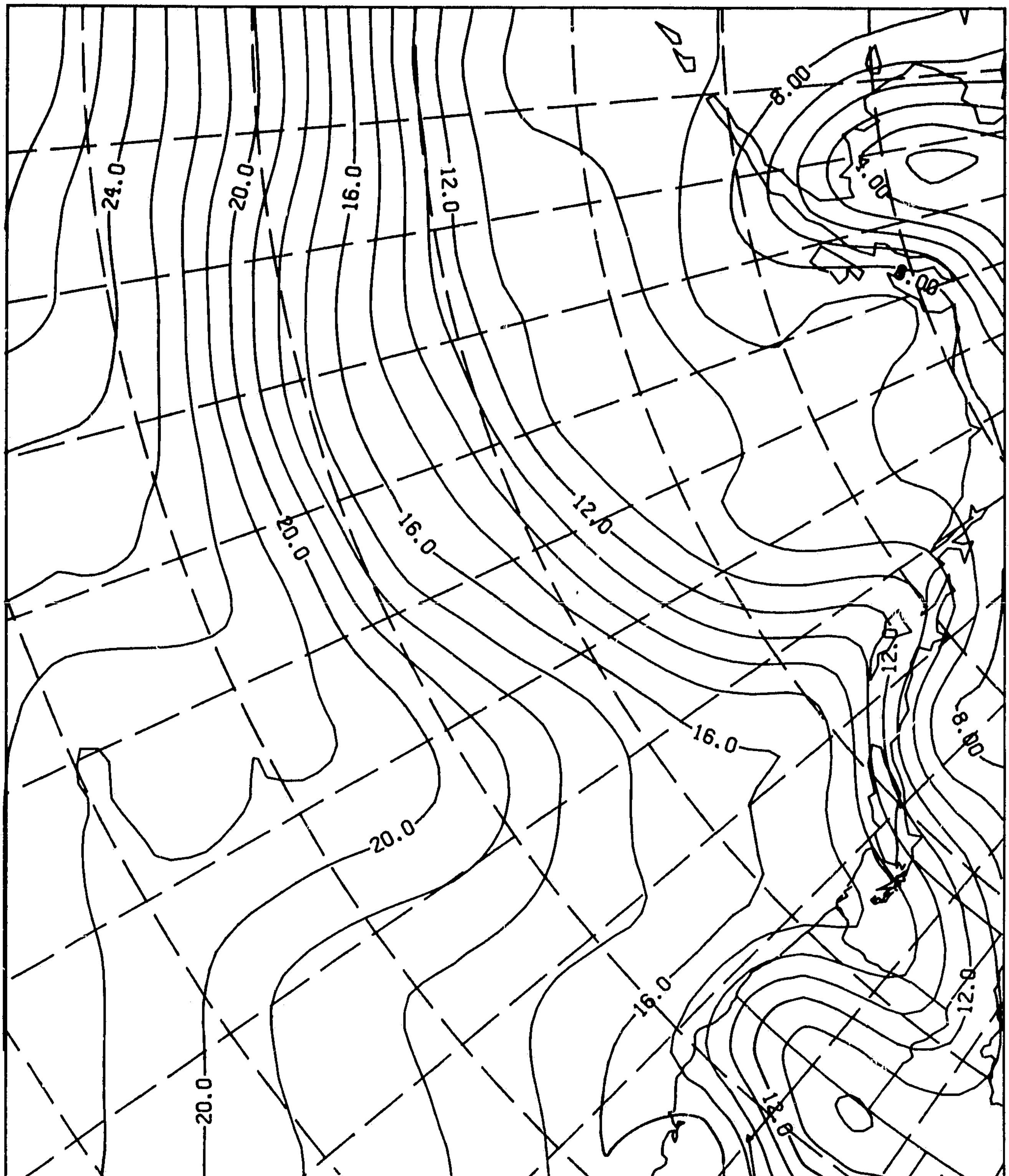
18Z 16 SEP 1978

ØBSERVED SAT



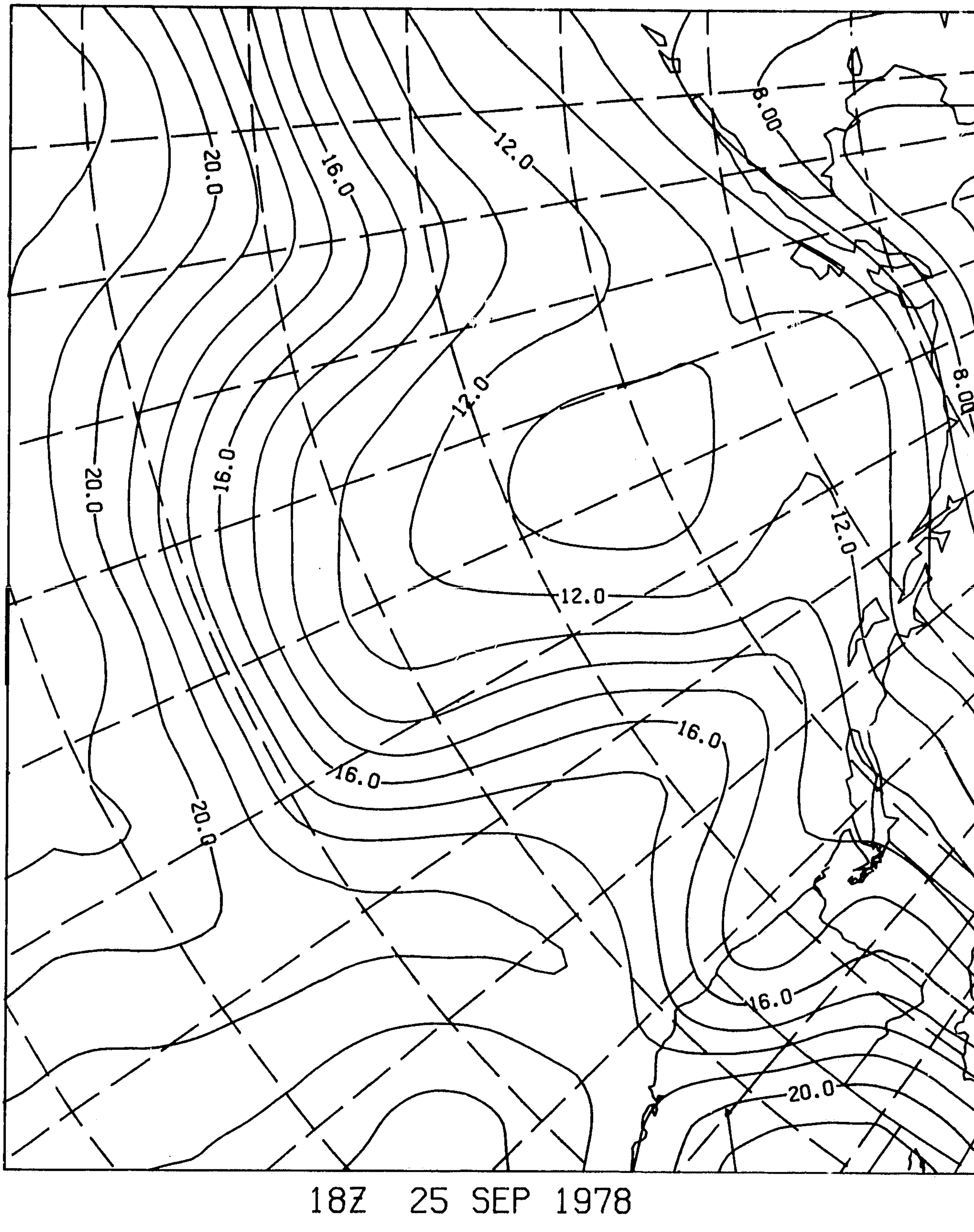
18Z 17 SEP 1978

ØBSERVED SAT



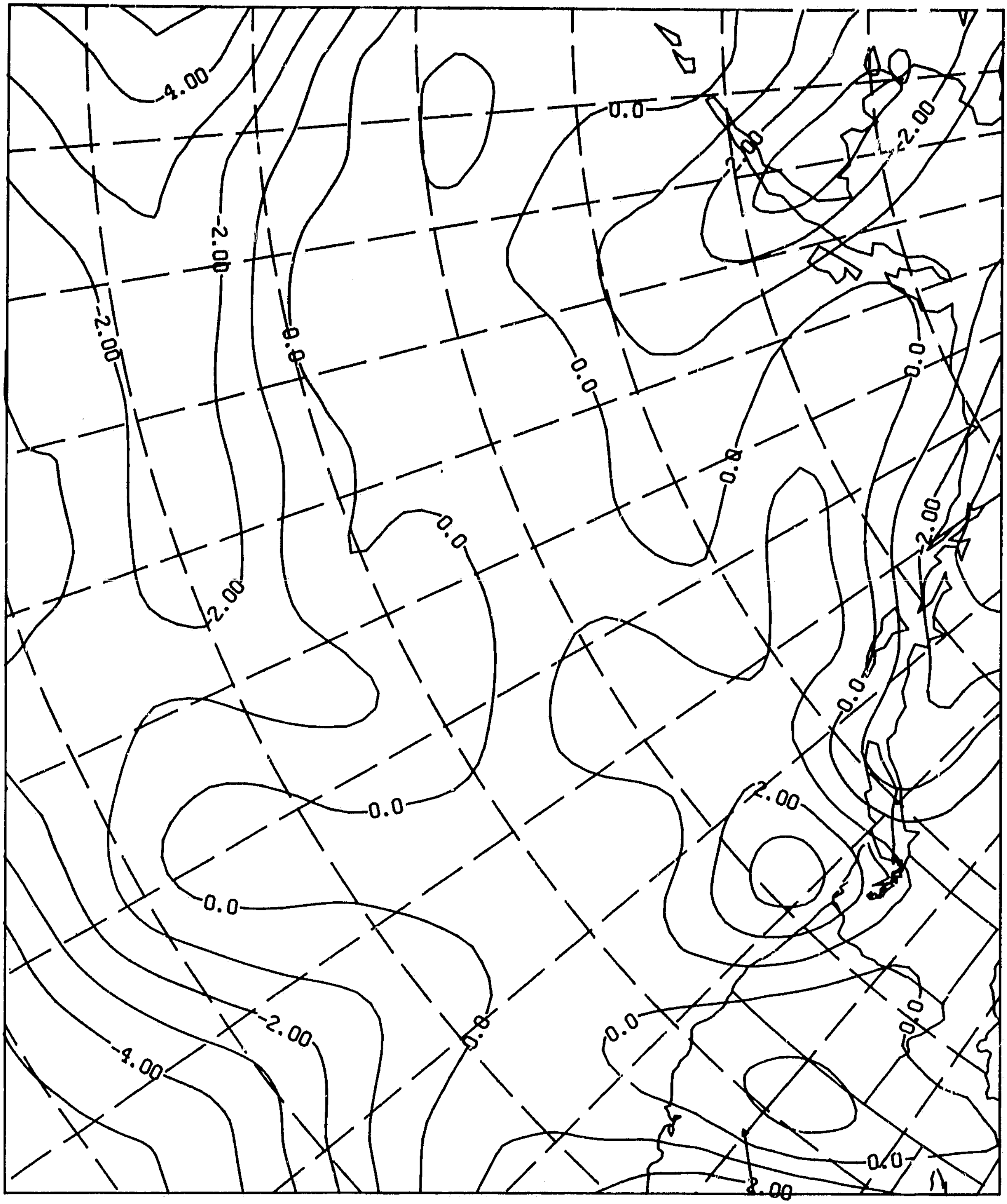
18Z 19 SEP 1978

ØBSERVED SAT



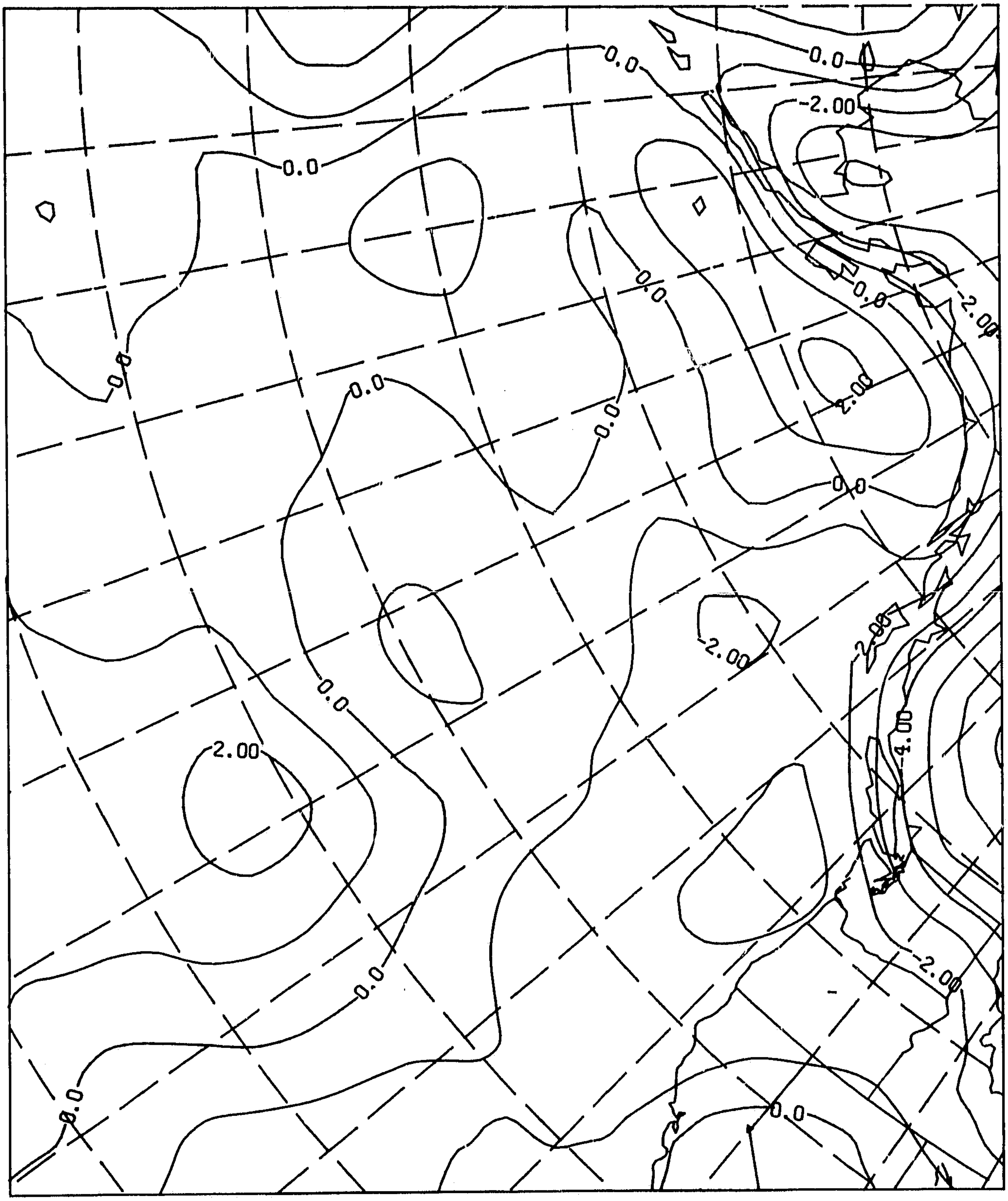
18Z 25 SEP 1978

ØBSERVED A-S DIFF



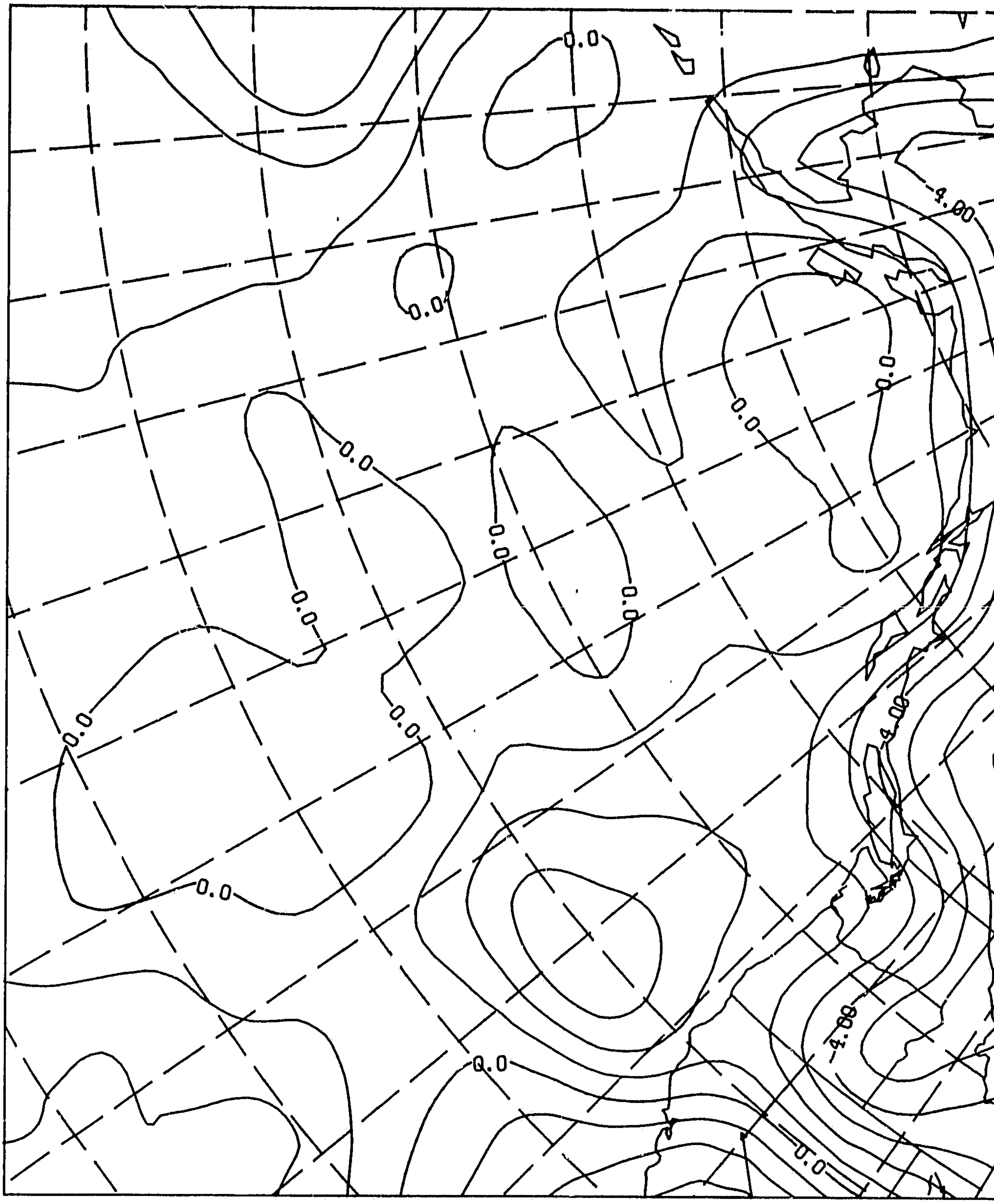
18Z 14 SEP 1978

ØBSERVED A-S DIFF



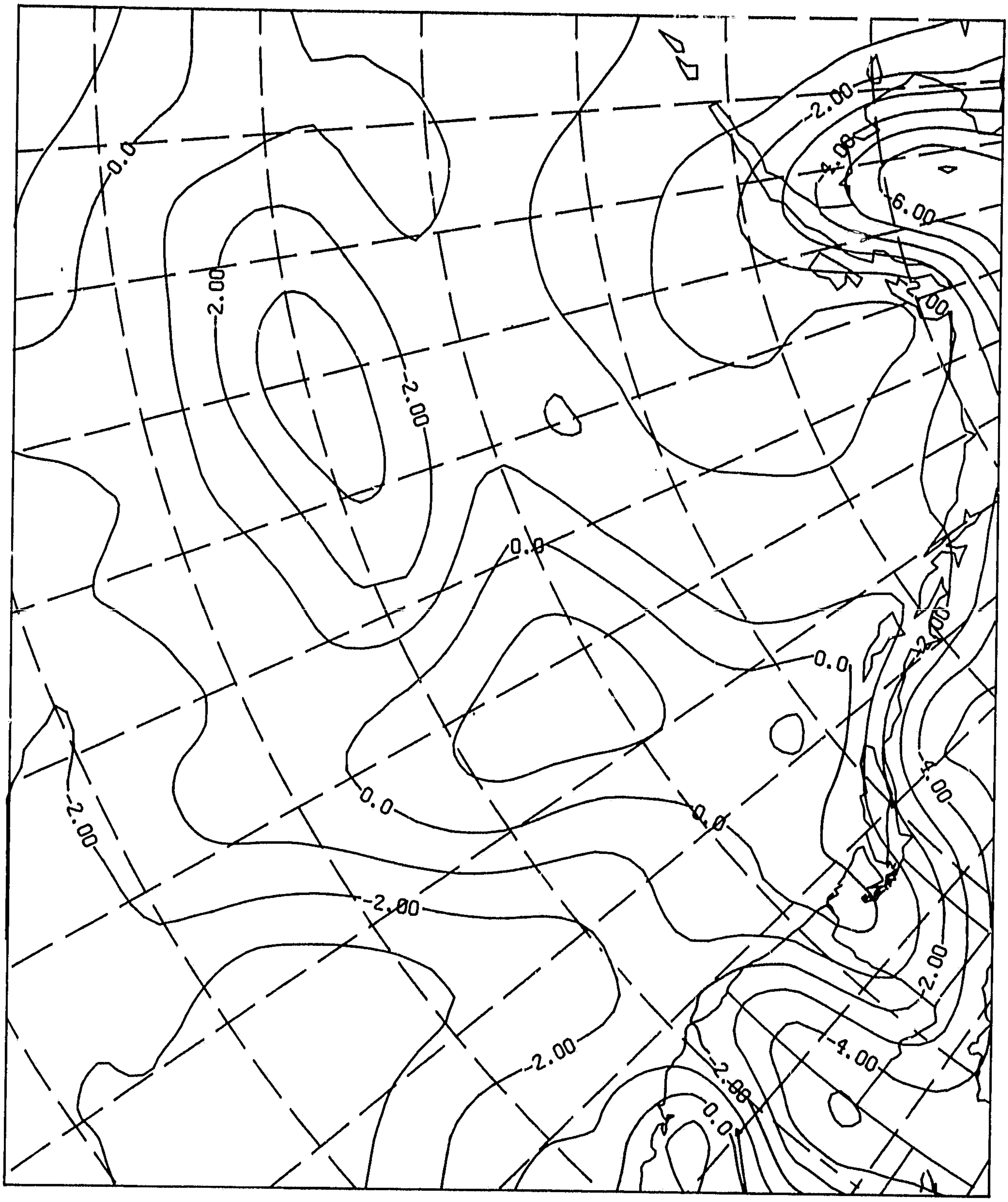
18Z 16 SEP 1978

ØBSERVED [illegible]-S DIFF



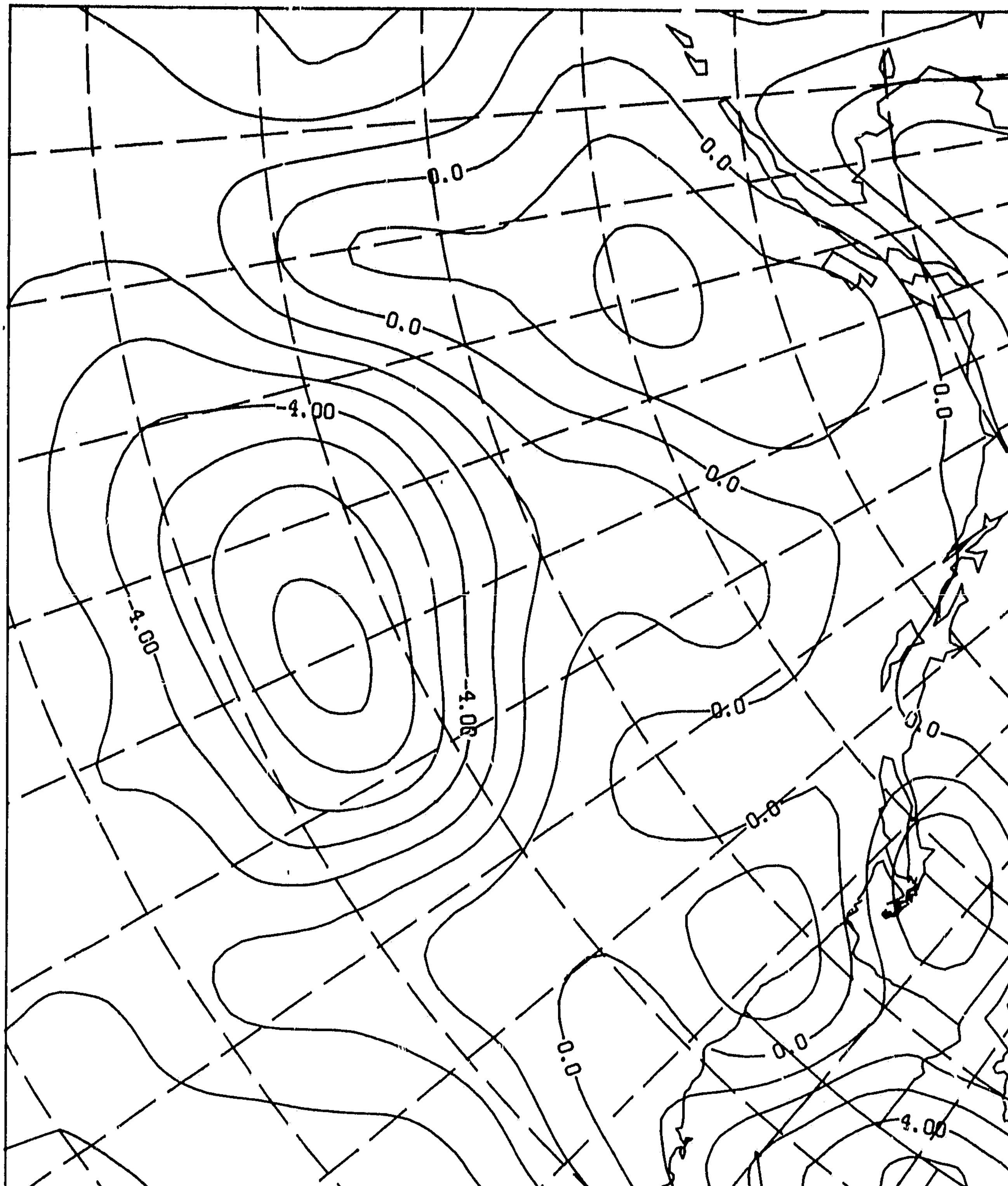
18Z 17 SEP 1978

ØBSERVED A-S DIFF



18Z 19 SEP 1978

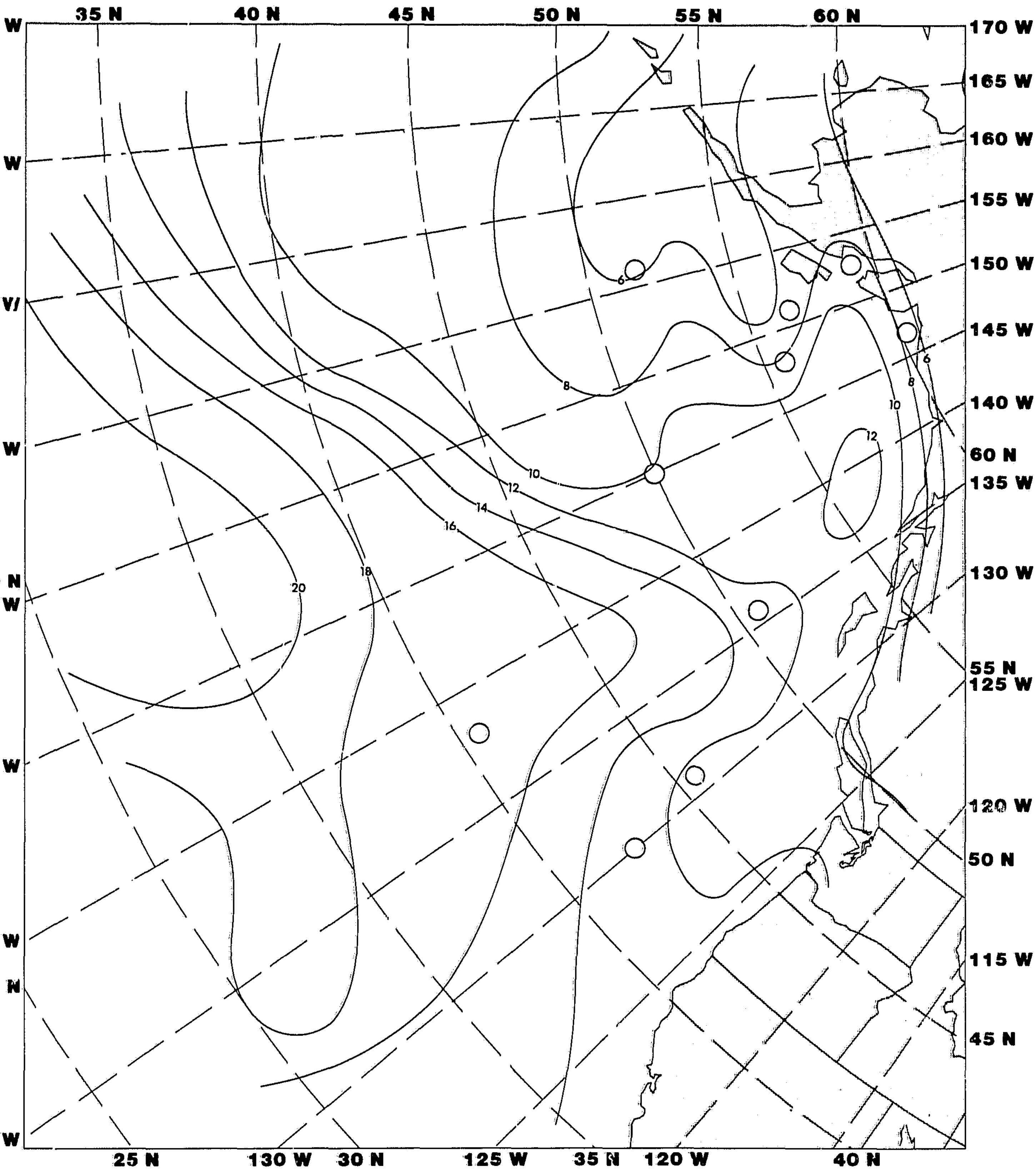
ØBSERVED A-S DIFF



18Z 25 SEP 1978

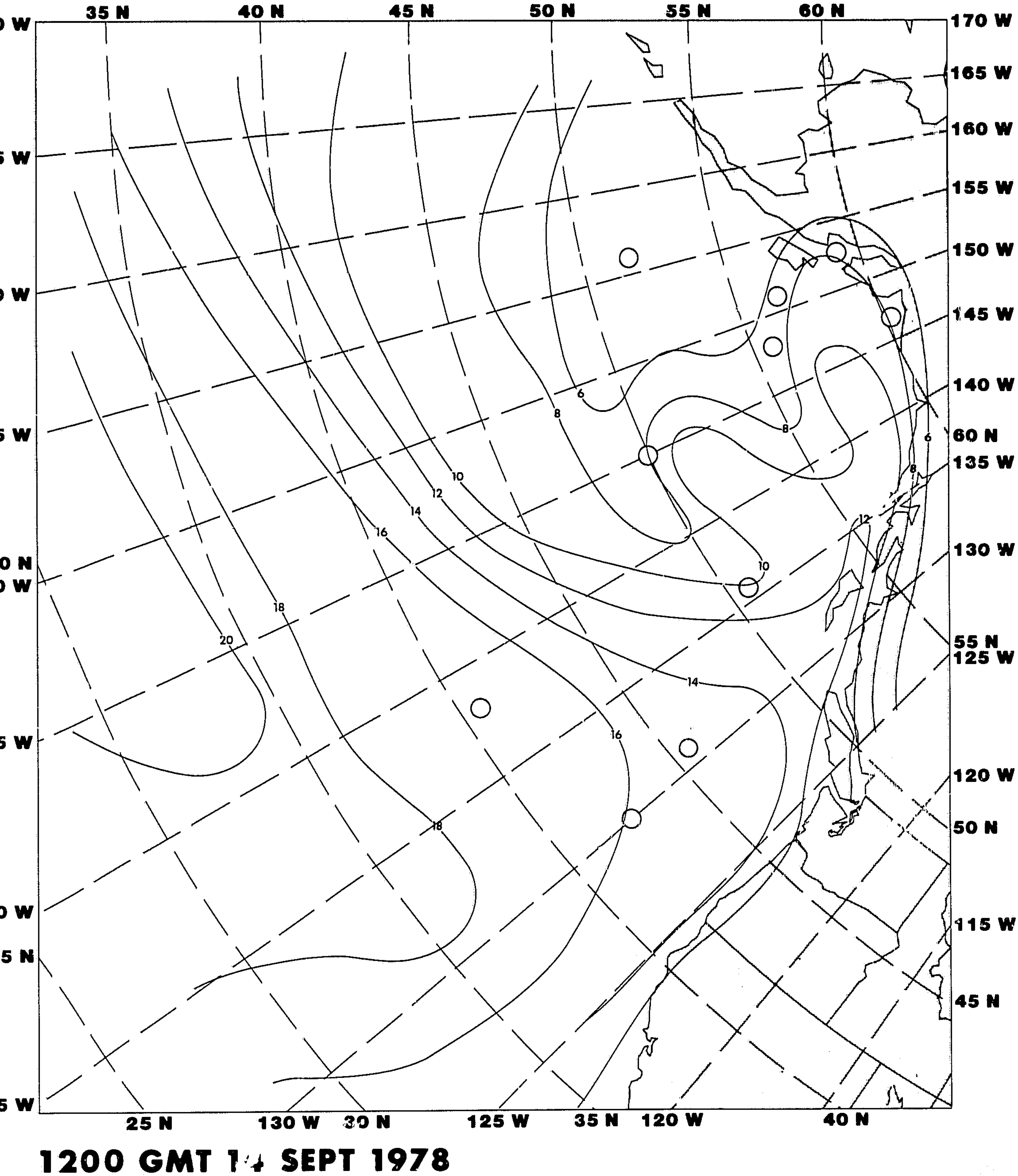
SECTION A-5
DEW POINT TEMPERATURE

SURFACE DEWPOINT, °C



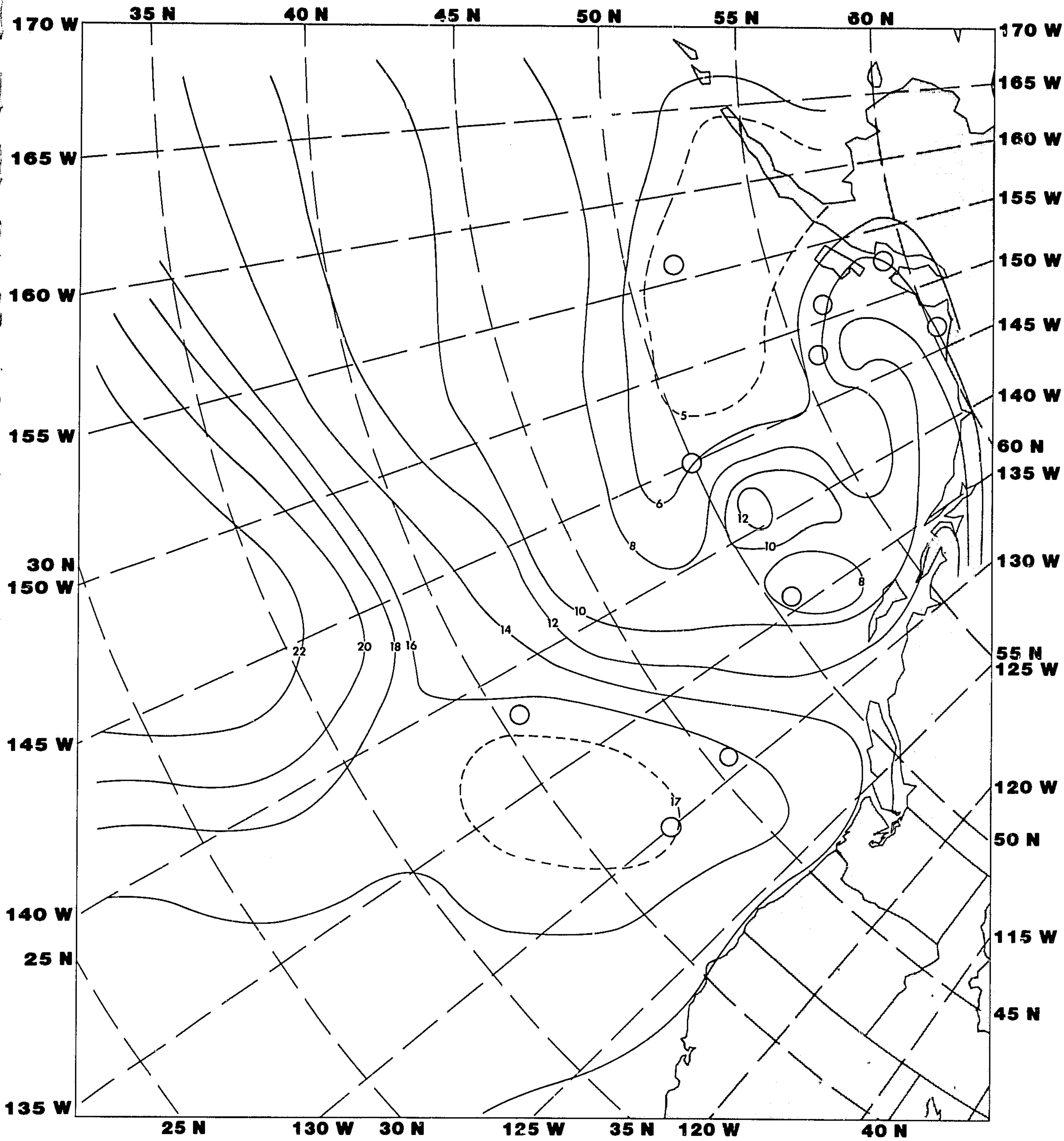
0600 GMT 14 SEPT 1978

SURFACE DEWPOINT, °C



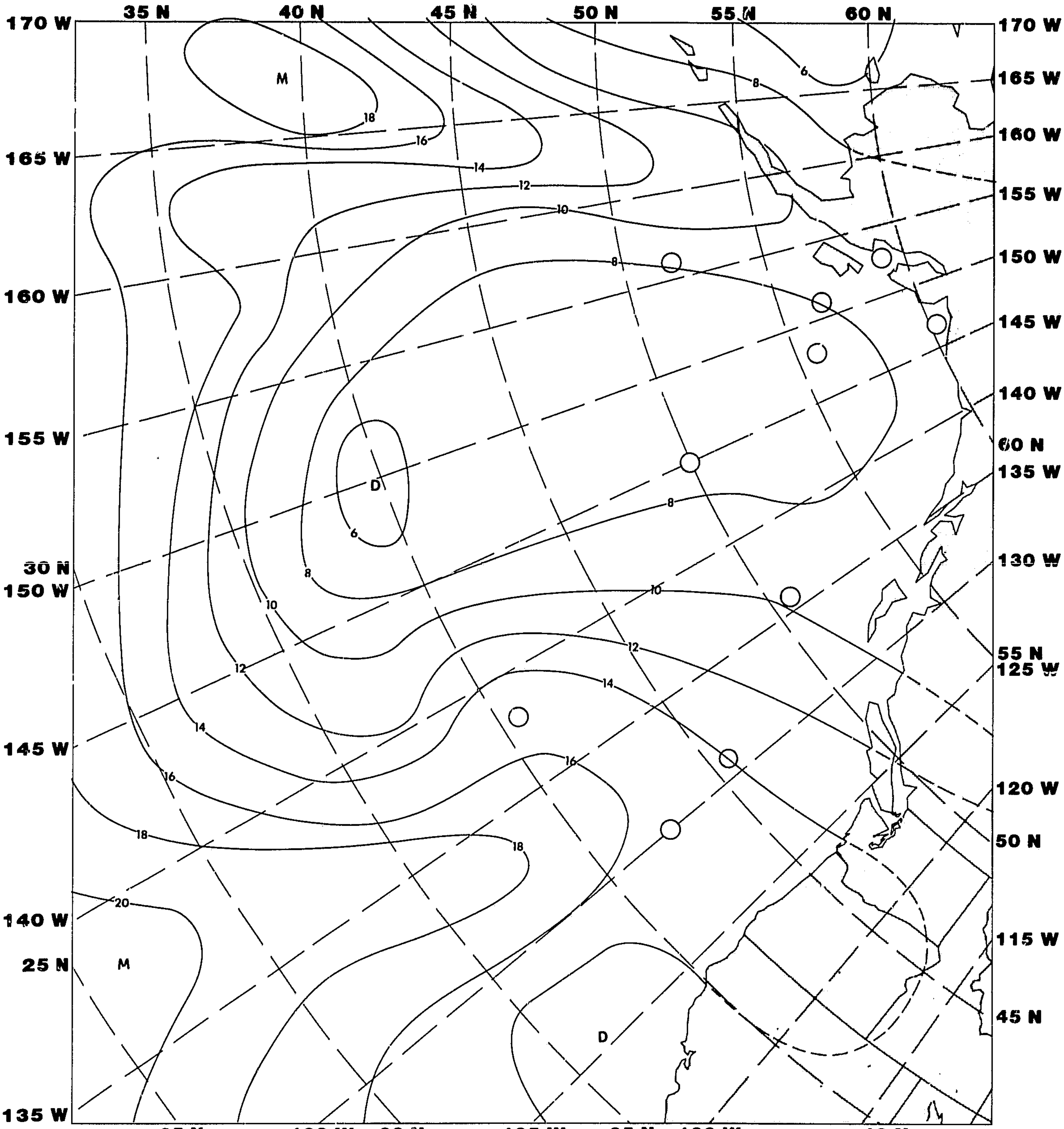
1200 GMT 14 SEPT 1978

SURFACE DEWPOINT, °C



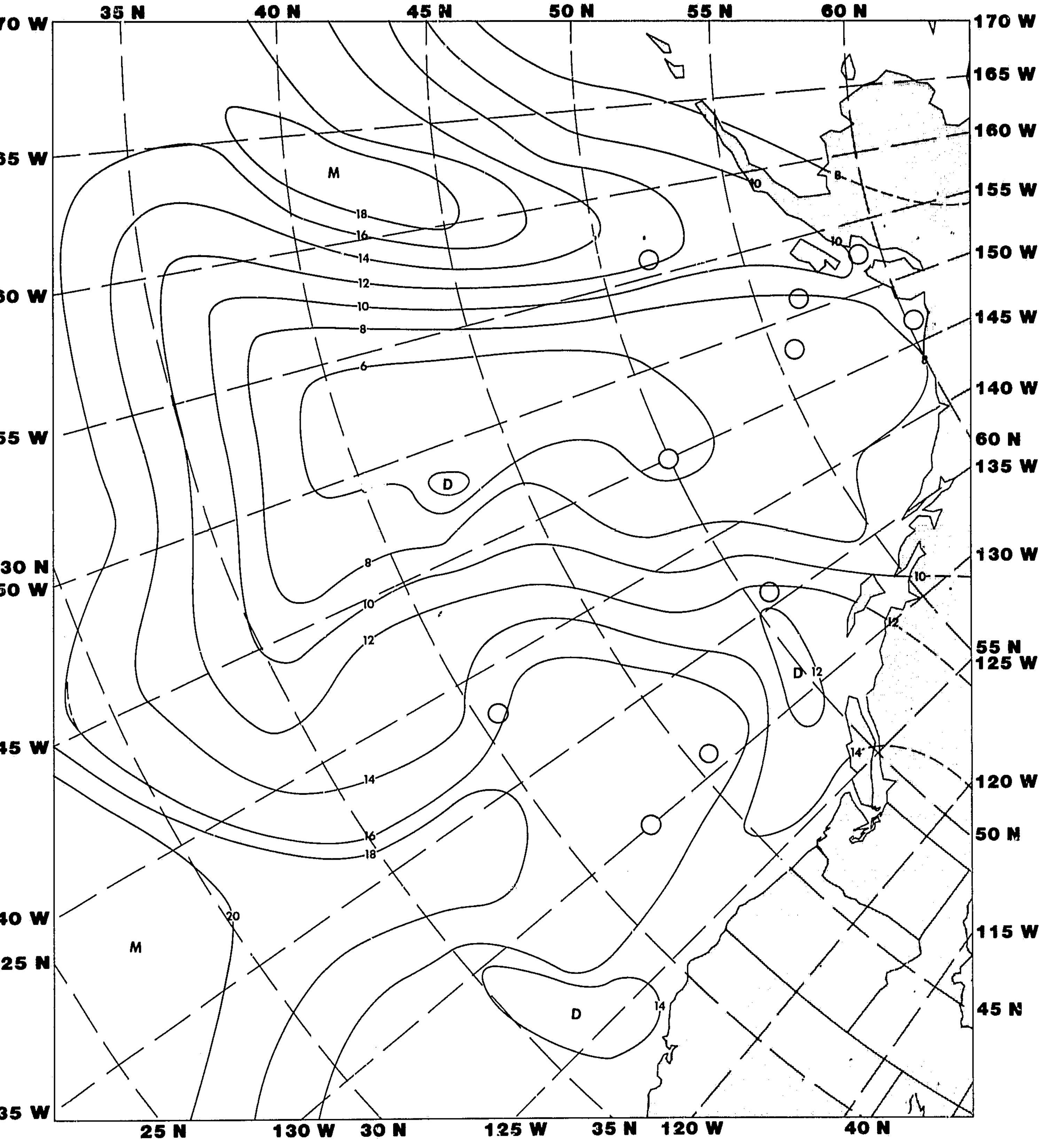
1800 GMT 14 SEPT 1978

SURFACE DEWPOINT, °C



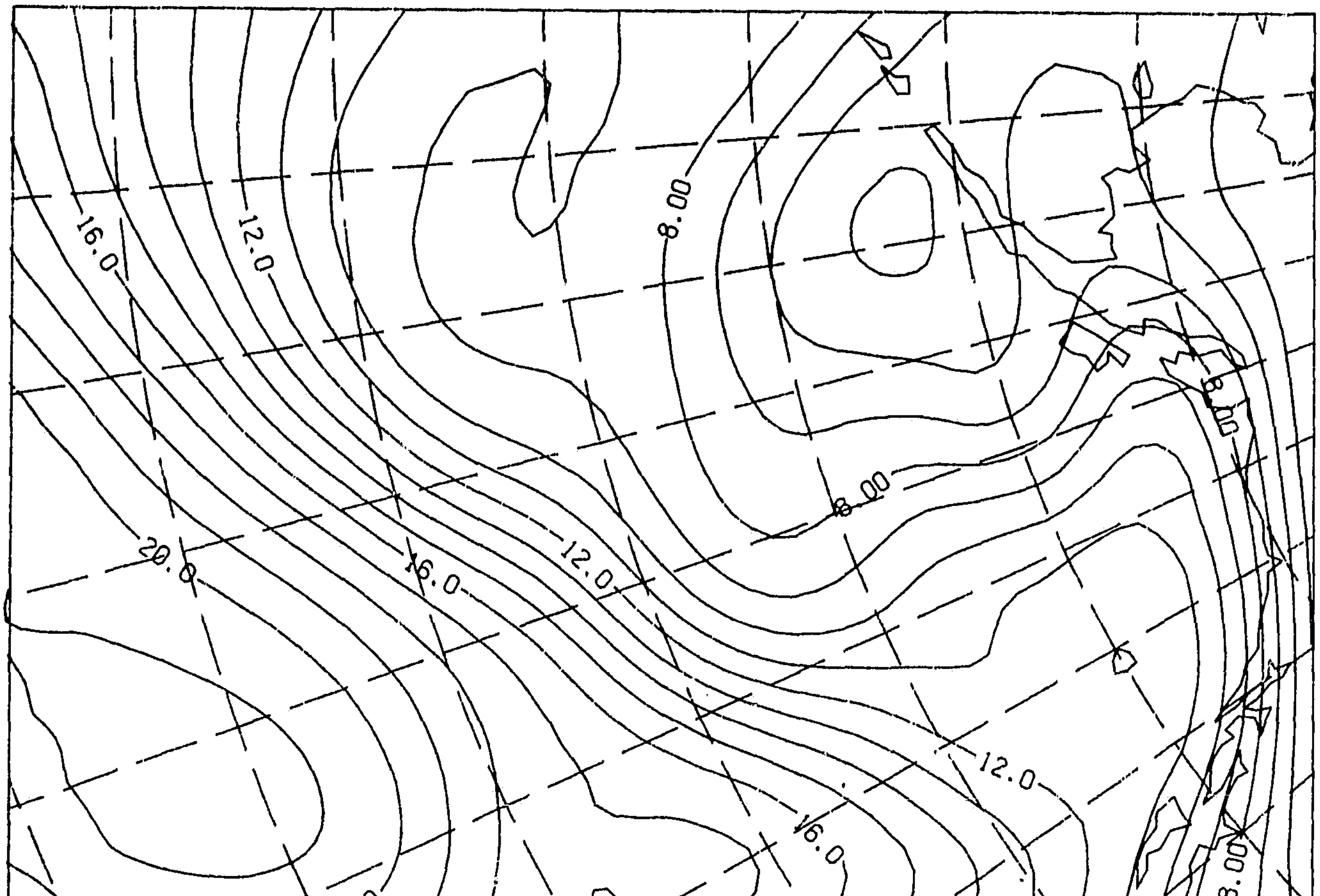
1200 GMT 25 SEPT 1978

SURFACE DEWPOINT, °C



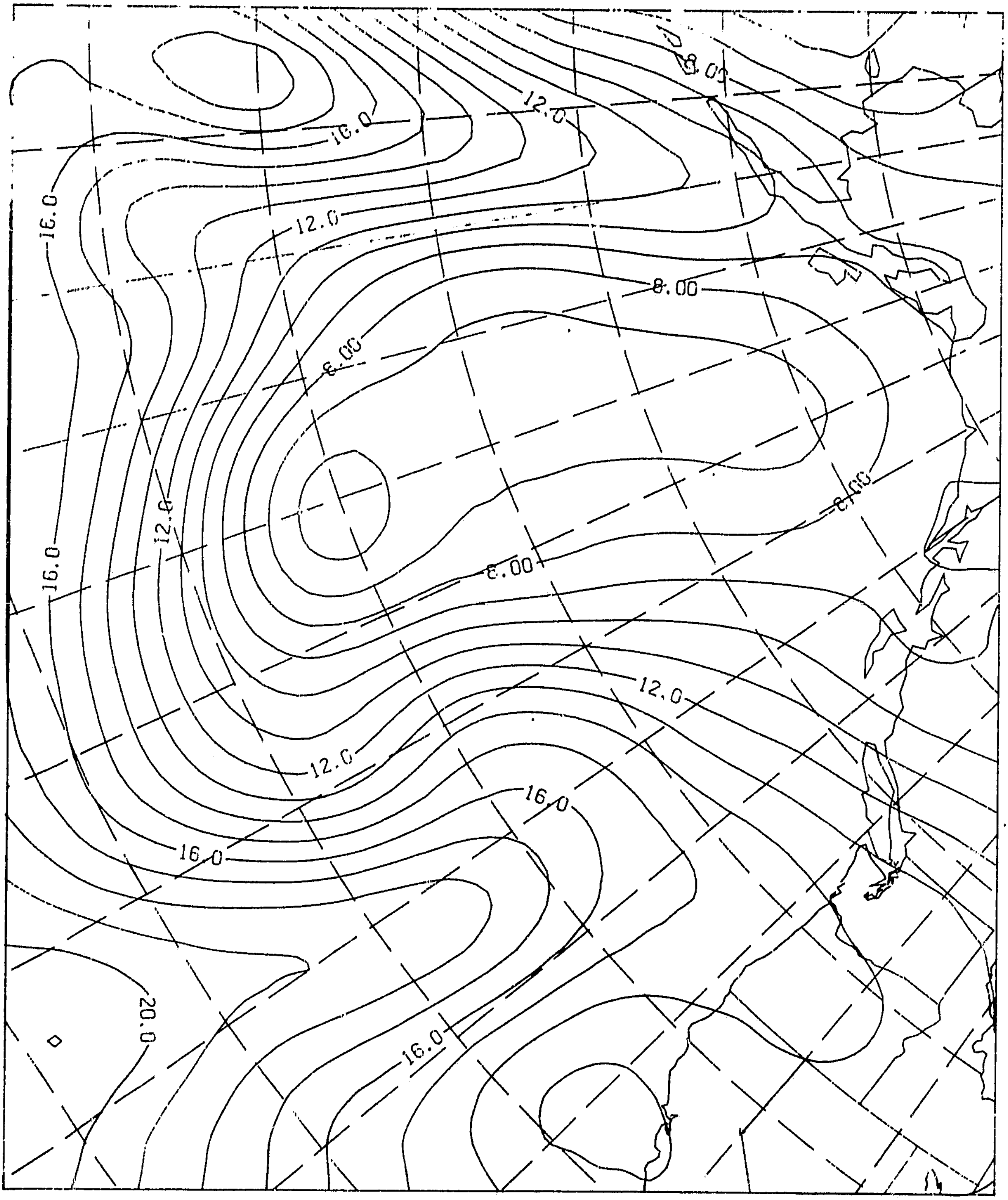
1800 GMT 25 SEPT 1978

OBSERVED DEW PT TEMP



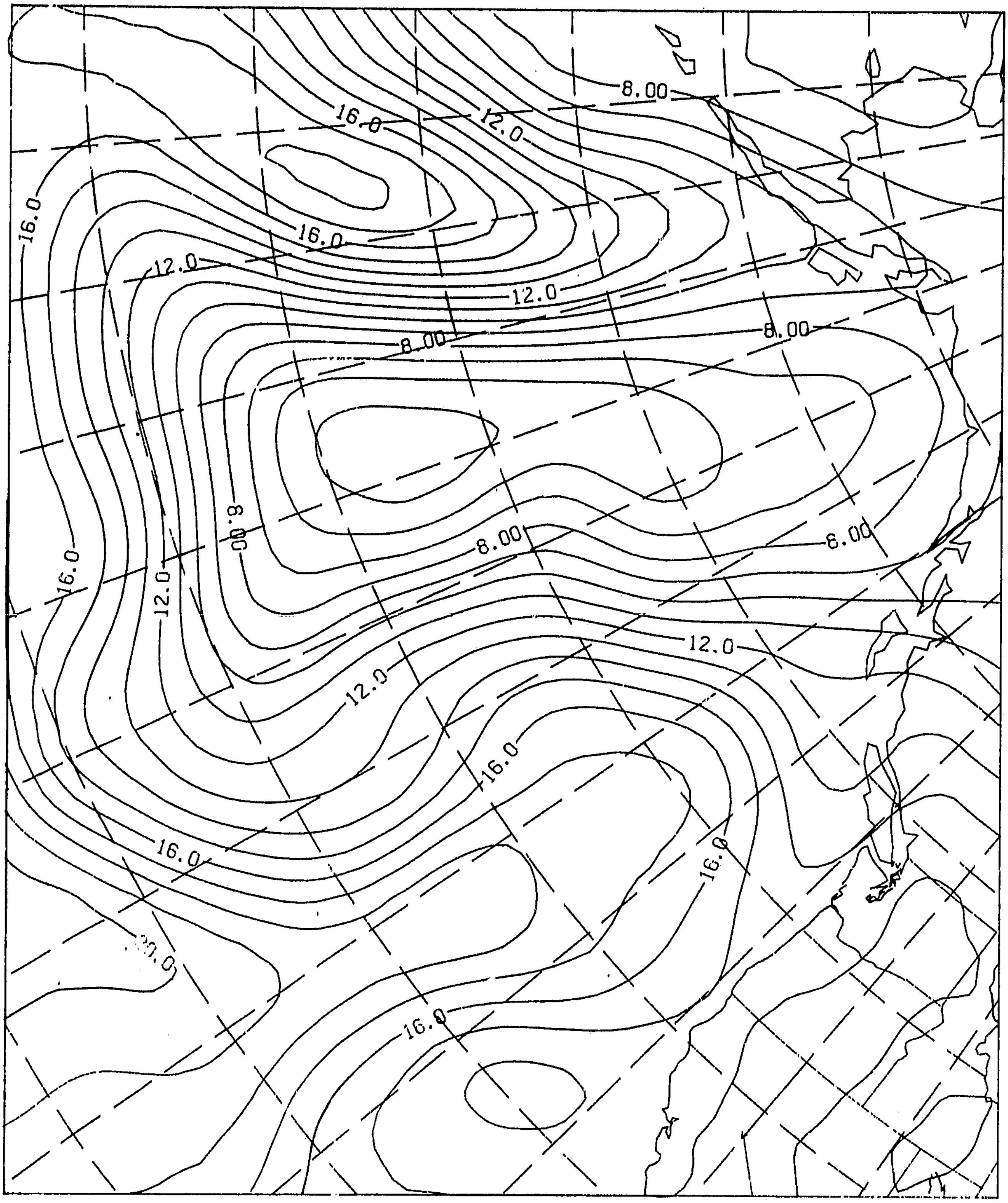
6Z 14 SEP 1978

OBSERVED DEW.PT TEMP



12Z 25 SEP 1978

OBSERVED DEW PT TEMP



18Z 25 SEP 1978

SECTION A-6

CLOUD COVER ANALYSES AND PRECIPITATION DATA

The neph- and precipitation-analyses were prepared for orbits 1134, 1135, 1140, 1298, and 1212 in steps as follows. First, a neph-analysis was constructed, using GOES IR imagery. Second, the GOES visual and IR-enhanced imagery were consulted together to determine (1) the regions of cloud at subfreezing temperatures, (2) the existence and location of cumulo-nimbus towers, and (3) the areas of cirrus cover without possibility of precipitating cloud underneath, and (4) the areas of low stratus cover only. Third, all available ship and buoy reports were plotted in the Seasat swaths and compared with the analysis for consistency. Fourth, on the basis of the foregoing data, a final analysis of clouds and precipitation areas was constructed. Naturally, not all categories of data were available for all revolutions.

The final analysis delineated the following areas: (1) areas of cloud cover without precipitation. These were primarily cirrus and low stratus cover (designated by stippling) or lines of scattered cumulus humilis or alto-cumulus (designated by dashes showing alignment of cloud streets); (2) areas of possible precipitation, designated by cross-hatching. In the terminology adopted, "possible" was <u>not</u> a subjective probability estimation, but was defined to mean that within the area so designated, any given geographic point at the surface would have a probability between 0 and 0.4 of being in precipitation. Thus, a beam irradiating a cell at an incidence angle of, say, 45 degrees could be said to undergo light attenuation; (3) areas of probable precipitation, designated by double-cross-hatching. Here a given point in the area would have a probability between 0.4 and 0.8 of being in precipitation. The irradiating beam would correspondingly undergo moderate attenuation; and (4) areas of almost certain precipitation, designated by solid black. Here a point would have a probability between 0.8 and unity of being in precipitation, and a beam would undergo heavy attenuation.

It will be noted that there are relatively few and small areas designated as almost certainly precipitating. Again, it is emphasized that this is not a measure of confidence, but reflects the situation that there were few regions of steady continuous rainfall on any of the GOASEX weather charts. The areas of precipitation were characteristically showery and drizzly, with many rain-in-past and rain-in-sight weather designators. The few areas in category (4) were located by ship observations, indicating extensive frontal precipitating regions, or by large towering cloud masses unambiguously identified in IR-enhanced and visible satellite imagery.

The latitude-longitude one-degree grid values of cloud and precipitation probability were prepared from the neph- and precipitation-analyses, using the code 1-5 to indicate extent of non-precipitating cloud cover; 6-8 to indicate possible, probable and almost certain precipitation; 8-10 for cases in which the latitude-longitude square was partially covered by non-precipitating or precipitation cloud and partially clear. These last three categories are fairly numerous because of the very sharp cloud boundaries associated with frontal systems. In some cases, the cumulonimbus towers were positioned close to the edge of these cloud boundaries so that it was possible to specify (within the error of GOES gridding) the existence of both rain and clear areas within a given latitude-longitude square.

9k

PRECIPITATION PROBABILITY

GRID: NORTH LATITUDE WEST LONGITUDE

CODE: Latitude/longitude intersection is center for a one-degree square area with the following designations.

$$\left.\begin{array}{ll} 1: & \text{Zero to 10 percent cover} \\ 2: & \text{10 to 30 percent cover} \\ 3: & \text{30 to 60 percent cover} \\ 4: & \text{60 to 90 percent cover} \\ 5: & \text{90 to 100 percent cover} \end{array}\right\} \text{No precipitation}$$

6: Possible precipitation

7: Probable precipitation

8: Almost certain precipitation

9: Part of grid square coded 6, part 1-5

10: Part of grid square coded 7 or 8, part 1-5

REV 1140

	123°W	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146°W
30°N				---	---	3	3	---	---															
31°			---	---	3	3	3	3	---	---														
32°		---	---	2	3	3	3	2	3	---														
33°	---	---	2	2	2	2	2	2	2	---	---													
34°	---	1	2	2	2	2	2	2	2	2	---	---												
35°	2	2	2	2	2	2	2	2	2	2	2	---												
36°	2	1	1	1	2	2	2	2	2	2	1	---	---											
37°	1	1	1	1	2	2	2	2	2	2	2	2	---	---										
38°	1	1	1	1	2	2	2	2	2	2	2	2	2	---	---									
39°	---	1	1	1	2	2	2	2	2	2	2	1	1	1	---	---								
40°	---	---	1	1	2	2	3	3	2	2	2	1	1	1	1	---								
41°		---	1	1	2	3	9	3	2	2	3	2	1	1	2	---	---							
42°		---	1	2	9	5	5	2	3	3	3	3	3	3	4	5	---	---						
43°		---	1	2	6	9	5	4	4	3	5	5	4	4	5	5	5	---	---					
44°		---	1	9	6	5	5	4	4	5	5	5	5	5	5	3	2	2	---	---				
45°		---	---	6	9	5	6	6	5	5	6	5	4	3	2	2	2	2	2	---	---			
46°			---	---	5	5	5	9	9	7	9	4	3	2	2	2	2	2	2	2	---	---		
47°	147 W.LON.			---	---	1.	7	7	6	4	9	6	3	2	2	3	2	2	2	2	2	---	---	---
48°	---	148	149		---	6	6	3	4	6	9	6	9	3	3	3	3	3	3	3	3	3	3	---
49°	3	---	---	150	---	---	4	9	6	9	9	4	3	3	3	3	3	3	3	3	3	3	3	3
50°	3	3	3	---	151	---	---	9	4	6	3	4	4	3	3	3	3	3	3	3	3	3	3	3
51°	3	3	3	3	---	152	---	---	---	3	5	5	3	3	3	4	4	4	4	4	3	3	3	3
52°	3	3	3	3	3	---	153	154	---	---	5	5	3	3	4	4	4	4	5	5	5	4	4	4
53°	4	4	4	4	4	4	---	---	155	---	---	4	3	4	4	4	4	5	5	5	5	4	4	4
54°	4	4	4	5	5	5	5	4	---	156	---	---	4	4	5	5	5	9	5	5	5	5	4	4
55°	5	9	9	9	10	10	10	5	5	4	157	---	---	---	5	5	6	6	6	9	5	5	5	5
56°	5	9	10	9	7	7	7	7	6	10	10	---	---	---	---	4	9	6	9	9	6	9	9	5
57°	6	9	10	7	10	5	7	7	7	7	---				---	---	4	5	5	9	6	9	6	6
58°	9	3	3	3	4	10	7	---	---	---	---					---	---	---	4	3	6	9	9	9
59°	6	9	3	3	4	7	7	---	---									---	---	---	9	9	9	9
60°N	4	3	---	---	---	---	---	---												---	---	---	3	3
	---	---	---	---																				

REV 1298

	123°W	4	5	6	7	8	9	130	1	2	3	4	5	6	7	8	9	140	1	2	3	4	5	146°W
28°N						---	---	---	3	3	---													
29°						---	3	3	3	3	---	---												
30°					---	1	3	3	4	3	3	---												
31°				---	---	1	3	3	4	3	3	---	---											
32°		---	---	---	1	1	3	3	3	9	3	9	---	---										
33°	---	---	3	1	2	2	3	3	4	4	4	9	9	---										
34°	---	1	3	2	2	2	2	2	3	9	3	1	3	---	---									
35°	2	2	3	3	3	3	3	4	9	9	1	1	9	6	---	---								
36°	2	3	4	3	3	4	4	3	1	1	1	9	6	9	3	---								
37°	1	3	4	5	5	9	9	2	1	1	3	6	9	4	4	---	---							
38°	1	3	9	9	9	6	4	1	2	1	4	6	3	3	4	7	---	---						
39°	---	4	6	6	5	6	3	1	3	1	4	7	5	3	3	7	7	---	---					
40°	---	---	4	6	6	4	3	1	3	---	---	---	---	---	3	10	10	10	---					
41°		---	5	9	6	4	4	1	3	2	---	---	---	---	---	---	---	---	---					
42°		---	5	5	5	4	4	3	2	3	6	---	---	---	---									
43°		---	5	5	6	5	4	4	3	2	4	---	---											
44°		---	5	5	6	5	5	4	3	3	6	---	---	---										
45°		---	4	6	9	9	5	4	3	5	6	7	7	---	---									
46°		---	9	7	7	4	5	3	2	5	6	6	10	10	---	---								
47°		---	5	9	5	10	6	4	5	5	7	6	10	7	6	---								
48°		---	10	10	7	7	9	5	4	5	6	10	7	7	8	---	---							
49°		---	---	3	7	10	6	4	4	5	5	5	10	7	7	7	---	---						
50°			---	---	6	5	9	5	5	6	6	5	7	7	6	7	7	---	---					
51°				---	---	5	5	5	9	6	6	5	10	7	7	6	10	7	---	---				
52°					---	4	4	3	4	3	3	9	9	9	5	4	3	3	3	---	---			
53°					---	---	---	1	3	---	2	1	2	1	3	2	2	3	3	4	---	---		
54°							---	---	2	1	1	1	1	1	2	2	2	2	2	2	2	---	---	
55°								---	---	---	1	1	1	2	2	1	1	1	1	1	1	2	---	---
56°	147	148	149							---	---	1	1	3	2	2	2	2	2	1	2	2	3	---
57°	4	---	---								---	---	---	1	1	1	1	1	2	2	2	3	3	---
58°	4	5	---										---	---	3	3	3	2	3	2	3	2	4	---
59°	5	5	5											---	---	---	1	1	1	1	1	1	4	---
60°N	5	5	---													---	---	---	---	---	---	---	---	---

REV 1134

	123°W	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	
24°N											---	---	4	4	4	---	---							---
25											---	4	4	4	4	4	---	---	---	---				---
26										---	---	4	4	4	4	4	4	4	4	---	---	---		---
27										---	4	4	4	4	4	4	4	4	4	4	4	---	---	---
28										---	3	3	3	3	3	3	4	4	4	4	4	4	4	---
29										---	4	4	3	4	4	4	4	4	4	4	4	4	4	---
30									---	---	3	3	3	3	3	3	3	3	4	4	4	4	---	---
31								---	---	4	4	3	3	3	3	3	4	4	4	4	4	4	---	
32								---	4	4	4	4	4	4	3	3	3	3	3	3	3	---	---	
33							---	---	4	3	3	4	4	3	3	4	3	3	3	3	3	---		
34							---	3	3	3	3	3	3	4	4	3	3	3	3	3	3	---		
35						---	---	3	3	3	3	3	3	4	4	4	3	3	3	2	2	---		
36						---	2	2	3	3	3	3	2	3	4	4	3	3	3	3	---	---		
37						---	3	2	2	2	3	3	2	3	3	4	4	3	4	3	---			
38				---	---	3	3	3	2	2	2	2	2	2	2	3	3	3	3	2	---			
39				---	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	---	---			
40			---	---	3	3	3	3	3	3	2	3	3	3	2	2	2	2	---	---				
41		---	---	6	9	4	3	4	5	4	3	3	3	3	2	2	2	2	---					
42		---	2	9	6	5	4	5	5	4	4	4	4	3	3	3	3	---	---					
43	---	---	2	9	6	5	5	5	5	5	5	5	4	4	3	3	4	---						
44	---	5	3	2	9	9	5	5	5	5	5	5	5	4	3	3	---	---						
45	---	5	4	2	9	9	5	5	5	5	5	5	5	3	4	4	---							
46	---	5	4	2	2	9	5	5	5	9	5	4	3	4	10	---	---							
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50			---	---	2	2	2	9	9	6	6	4	4	---	---									
51				---	---	3	3	9	6	6	9	4	5	---										
52					---	---	5	6	6	6	9	4	---	---										
53						---	---	6	6	7	7	---	---											
54 N							---	---	7	7	---	---												

REV 1135 (Page 1)

	134°W	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156W
29°N													---	---	4	---	---	---	---	---			
30												---	---	4	4	4	4	3	3	---	---	---	---
31											---	---	3	3	3	4	3	3	4	3	2	2	---
32											---	4	3	3	[illegible]	3	3	3	3	2	2	4	4
33										---	---	3	2	2	2	2	2	2	2	3	4	3	3
34									---	---	4	4	3	2	2	2	2	2	3	4	3	3	2
35								---	---	2	2	3	2	2	2	3	3	4	4	3	3	3	4
36								---	2	2	2	2	2	2	3	4	4	3	3	3	4	5	5
37								---	3	2	2	3	3	4	3	3	3	3	3	4	4	4	4
38								---	2	4	4	4	4	4	3	3	3	4	4	4	4	5	5
39								---	---	5	5	5	4	3	3	4	4	4	5	5	5	5	5
40									---	5	5	4	3	4	4	4	5	5	5	5	4	4	4
41								---	---	4	4	4	5	5	5	5	5	4	4	3	4	4	9
42							---	---	4	4	5	5	5	5	4	4	3	3	4	9	6	9	9
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44					---	---	4	4	3	3	3	3	2	2	2	2	2	2	2	3	9	9	9
45				---	---	3	4	4	3	3	3	9	9	3	9	9	5	6	6	6	9	9	9
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53						---	---	9	5	5	9	9	9	5	9	9	9	9	5	9	9	9	6
54					---	---	9	9	9	9	5	9	9	5	5	5	5	5	5	5	5	5	5
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59		---	---	---	7	7	10	10	10	10	10	10	10	10	10	7	7	7	7	---	---		
60N					---	---	7	7	7	7	7	7	7	7	7	7	---	---	---	---			
						---	---	---	---	---	---	---	---	---	---	---	---						

REV 1135 (Page 2)

	157	158	159	160	161	162	163	164	165	166	167	168W
31°	---	---	---	---	---							
32	2	2	2	2	---	---	---	---	---	---	---	---
33	2	3	3	2	3	4	3	3	3	4	5	5
34	3	5	4	4	4	4	3	4	4	5	5	5
35	5	4	4	5	4	3	4	5	5	5	5	---
36	3	4	5	4	4	4	5	5	5	5	5	---
37	5	5	4	4	5	5	5	5	5	5	---	---
38	5	5	5	5	5	5	5	5	5	9	---	
39	5	5	5	5	5	5	5	5	5	9	---	
40	3	4	9	5	5	9	9	6	6	6	---	
41	9	6	9	5	9	6	6	7	7	---	---	
42	5	9	9	6	6	6	7	7	7	---		
43	4	6	6	6	6	7	7	7	---	---		
44	9	6	7	7	7	7	7	7	---			
45	9	10	10	10	10	10	10	---	---			
46	3	3	3	3	3	3	3	---				
47	3	3	3	3	3	3	3	---				
48	3	3	3	3	3	3	---	---				
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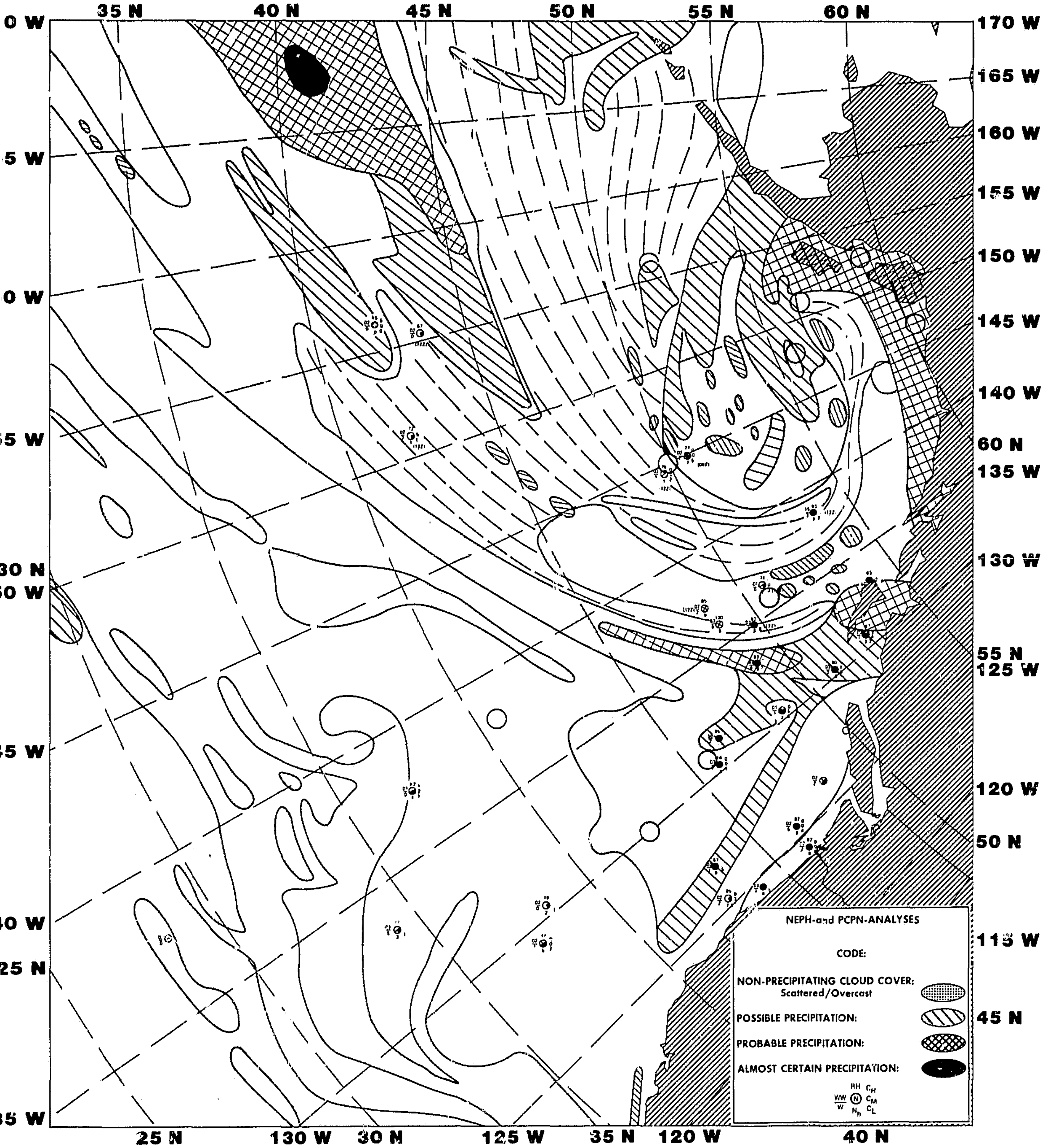
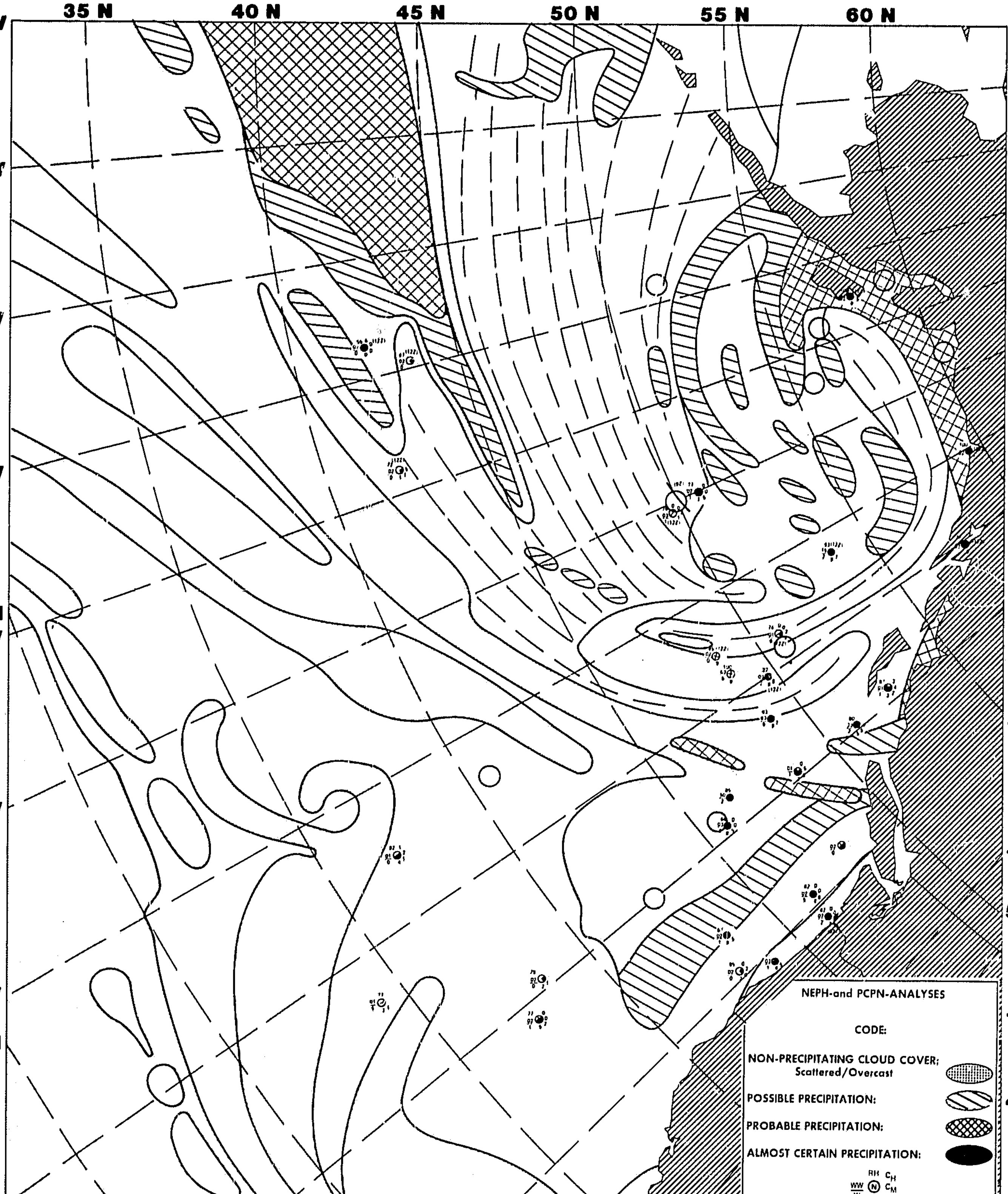
52	3	3	3	---	---							
53	9	3	3	---								
54	6	9	---	---								
55	9	---	---									
56	---	---										
57	---											
58												
59												
60N												

NEPH- AND PCPN- ANALYSIS



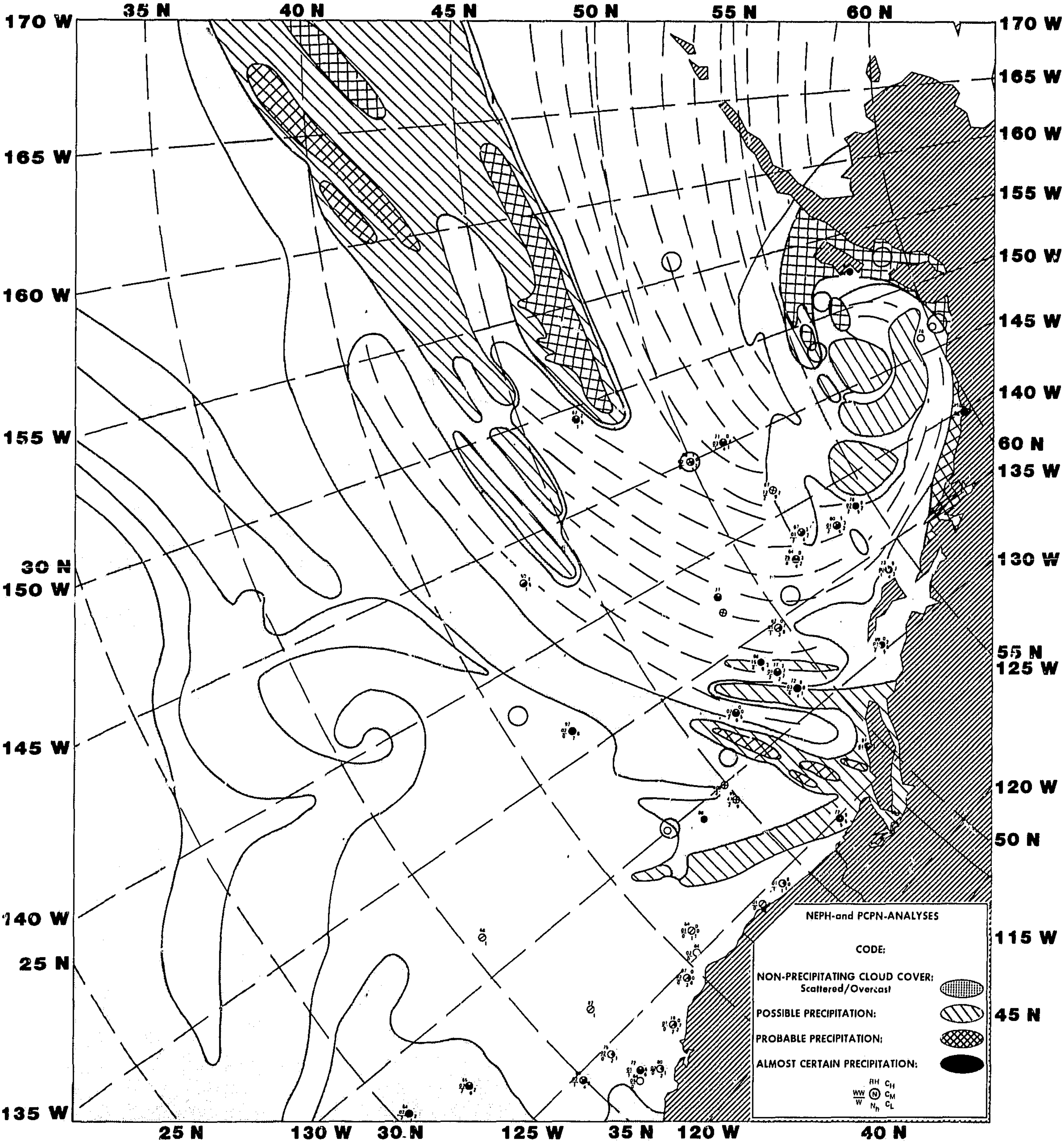
0730 GMT 14 SEPT 1978 **REV 1134**

NEPH- AND PCPN- ANALYSIS



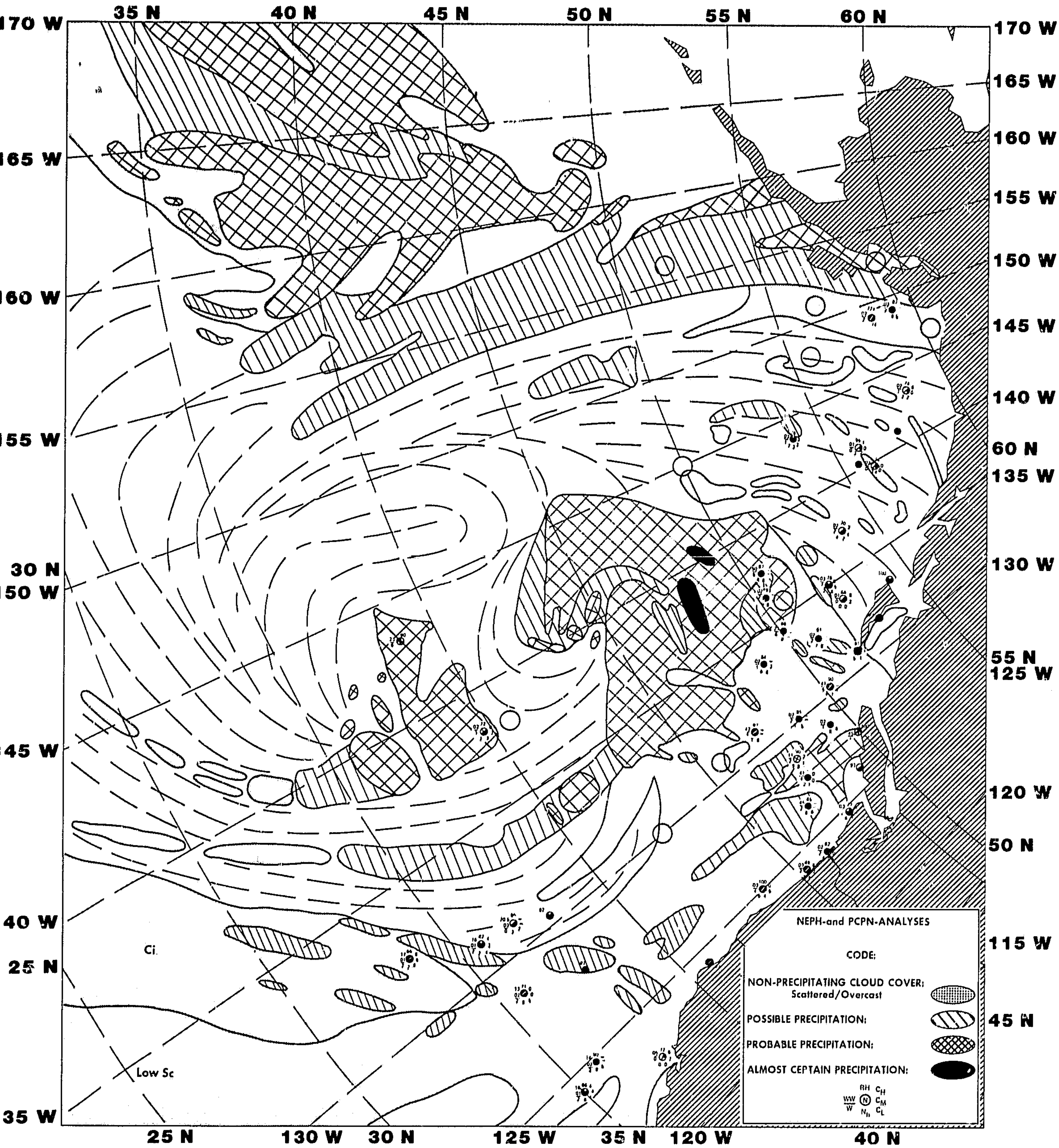
0900 GMT 14 SEPT 1978 **REV 1135**

NEPH- AND PCPN- ANALYSIS



1715 GMT 14 SEPT 1978 **REV 1140**

NEPH- AND PCPN- ANALYSIS



1830 GMT 25 SEPT 1978 **REV 1298**

SECTION A-7
KINEMATIC WIND FIELD ANALYSES AND CONFIDENCE FLAGS

Section A-7

KINETIC WIND FIELD ANALYSES AND CONFIDENCE FLAGS

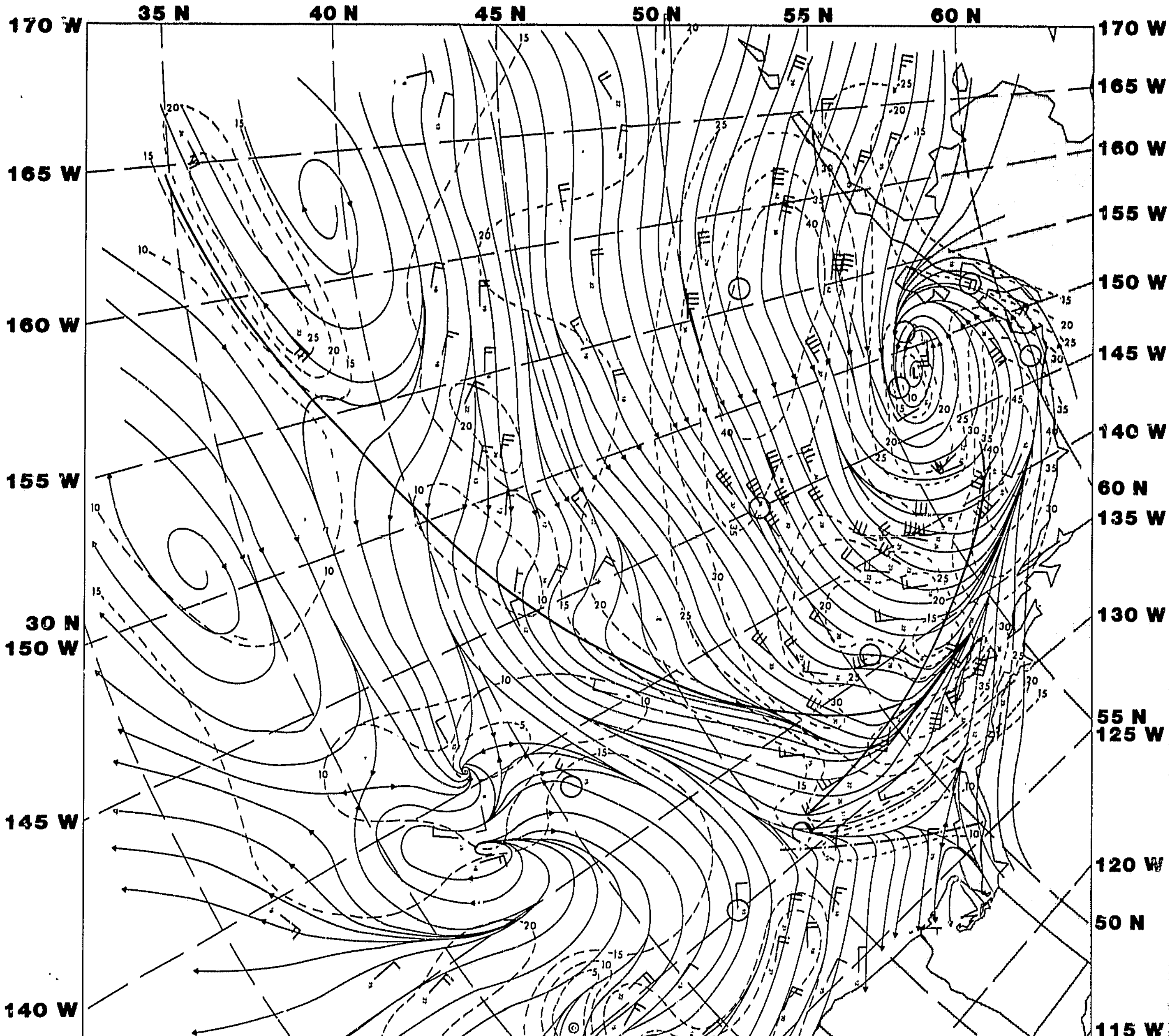
The method of analysis, described here as kinematic analysis, involves the classic manual synthesis of discrete meteorological observations into a continuous field. Applied to windfield analysis, the method is termed "kinematic", since the field of motion is determined primarily from wind measurements, with secondary consideration given to the forces which are causing the motion (cf. pressure gradients).

Kinematic analysis has certain advantages for the relatively sparse data available in the eastern North Pacific Ocean: unrepresentative ship reports can often be screened more effectively; ship observations not at synoptic times can be incorporated into the analysis. By imposing continuity considerations, an entire sequence of wind analyses at discrete times in a specific storm can be assembled into a credible three-dimensional series. This capacity for space-time analysis has never been effectively implemented in objective schemes.

Kinematic analyses were produced for orbits 1134/1135, 1140, 1292, and 1298. The northbound orbits (1298, 1140) occurred sufficiently close to 1800 GMT such that meteorological data for that standard synoptic time could be weighted heavily in the analysis. For orbits 1134/1135/1292, the ship data from 0600 and 1200 GMT were repositioned near dynamic features in the field to an equivalent 0900 GMT position, and a kinematic analysis representative of 0900 GMT was performed. For ship reports with anemometers at knwon heights, reported winds were reduced to an effective 19.5-m height and neutral stability. Beaufort estimates were corrected to equivalent 19.5-m wind speed, using the scale described by Cardone (1969). The kinematic analyses, therefore, may be considered to represent the effective 19.5-m wind.

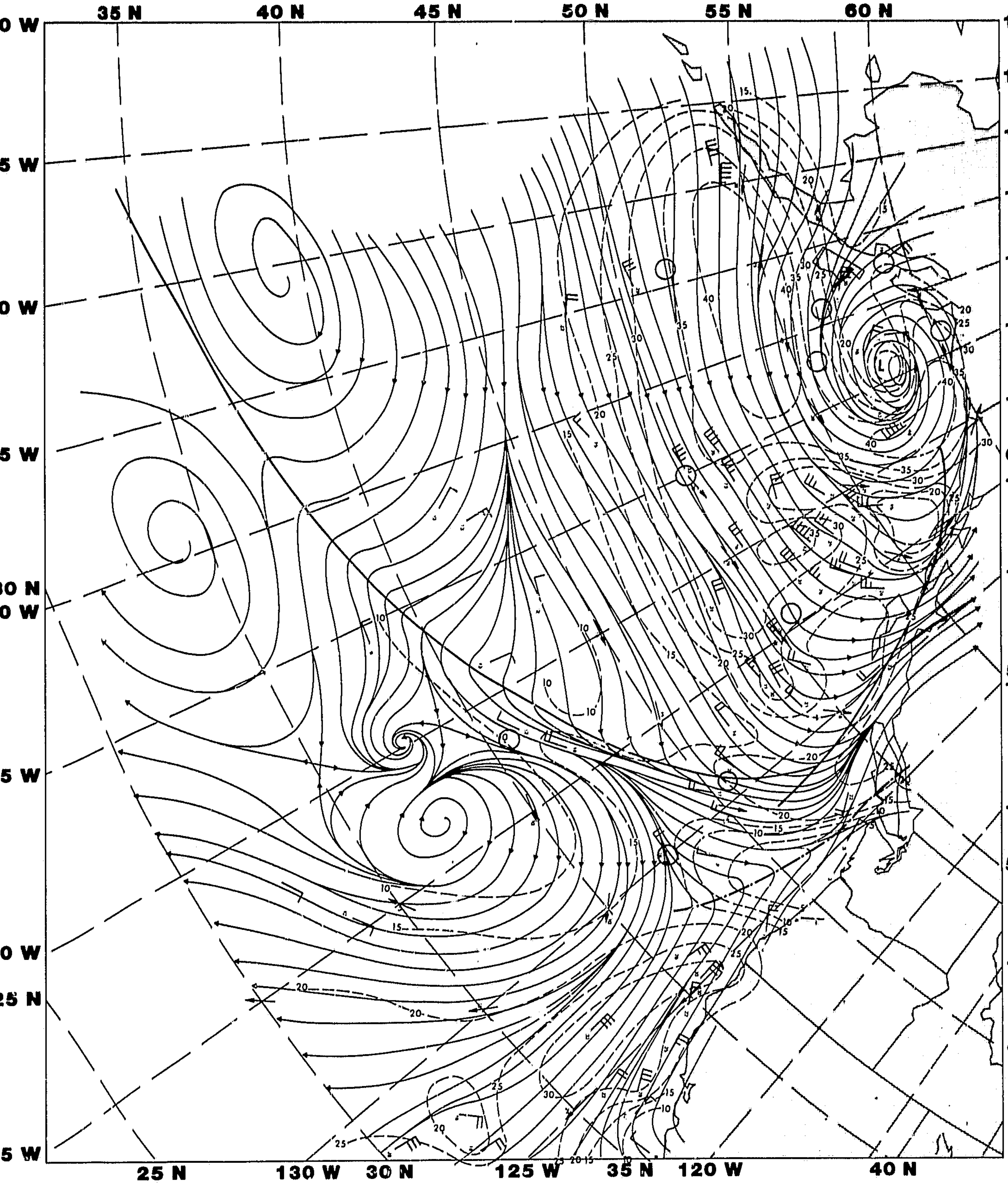
Subjectively derived confidence estimates are provided. They are based upon data density and the type of reporting platform. The highest quality is designated 2 and lowest confidence is 0.

SURFACE WINDFIELD, 19.5 m
(ISOTACHS IN KNOTS)



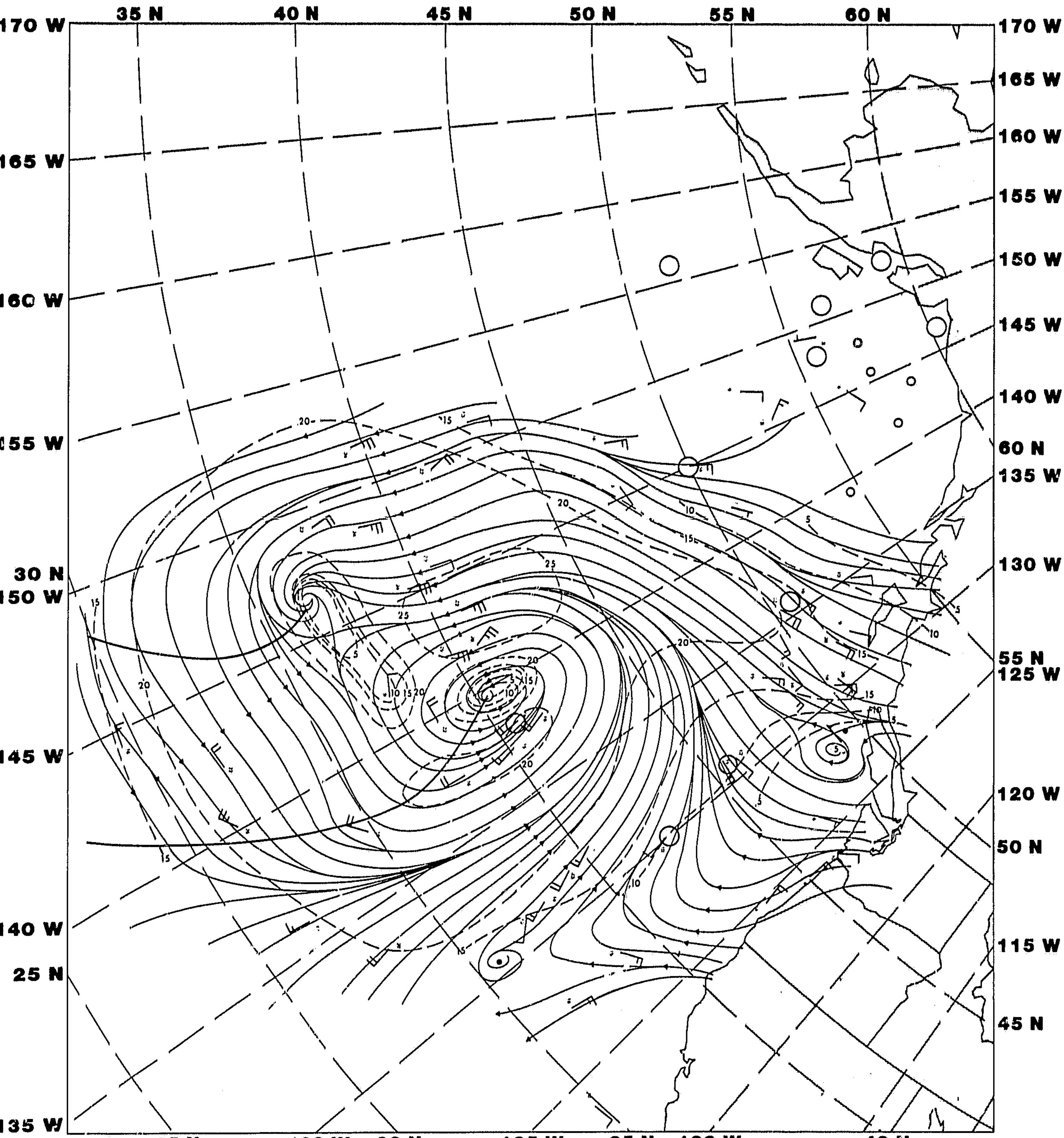
0900 GMT 14 SEPT 1978 **REVS 1134-1135**

SURFACE WINDFIELD, 19.5 m
(ISOTACHS IN KNOTS)



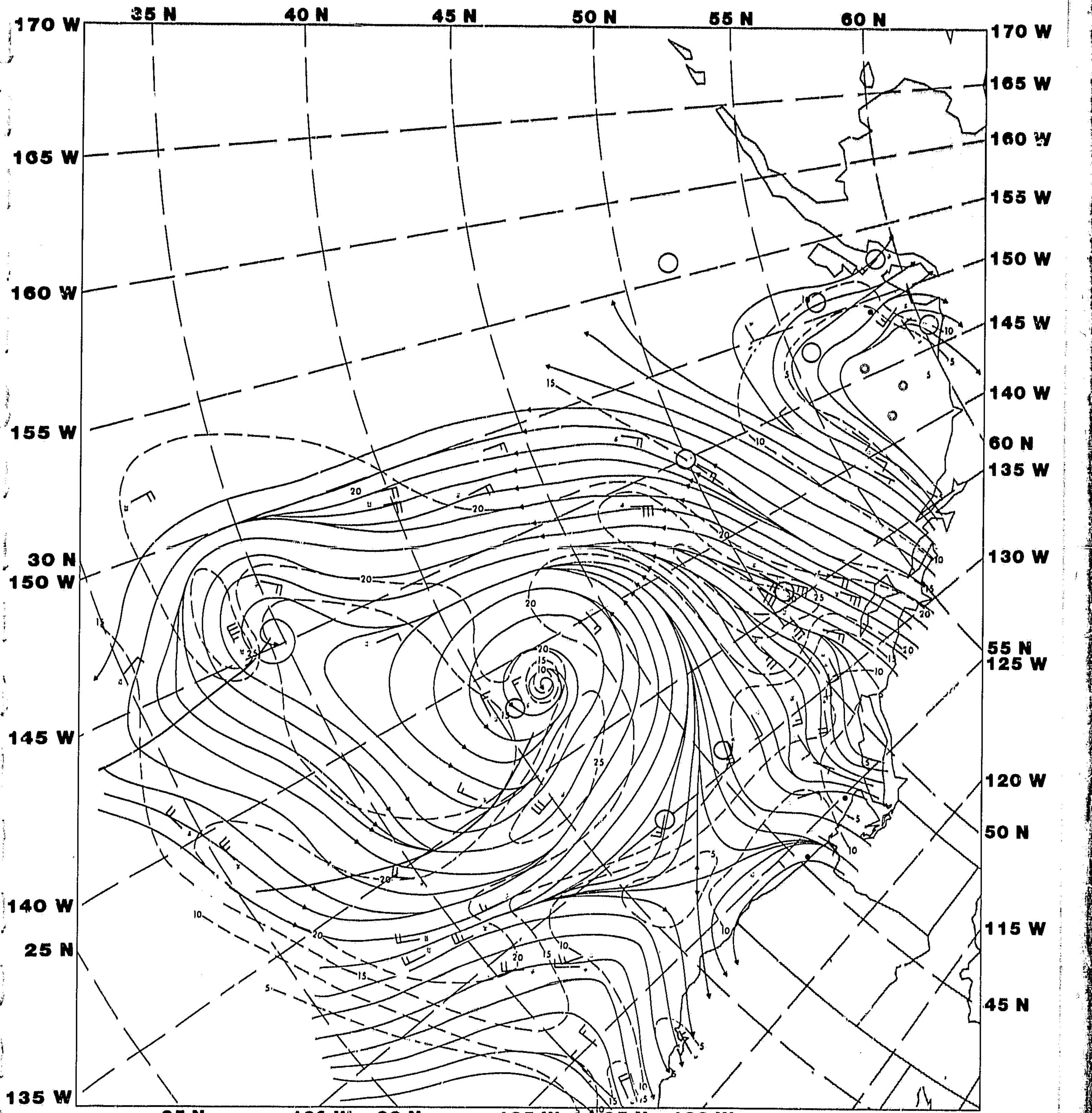
1800 GMT 14 SEPT 1978 **REV 1140**

SURFACE WINDFIELD, 19.5 m
(ISOTACHS IN KNOTS)

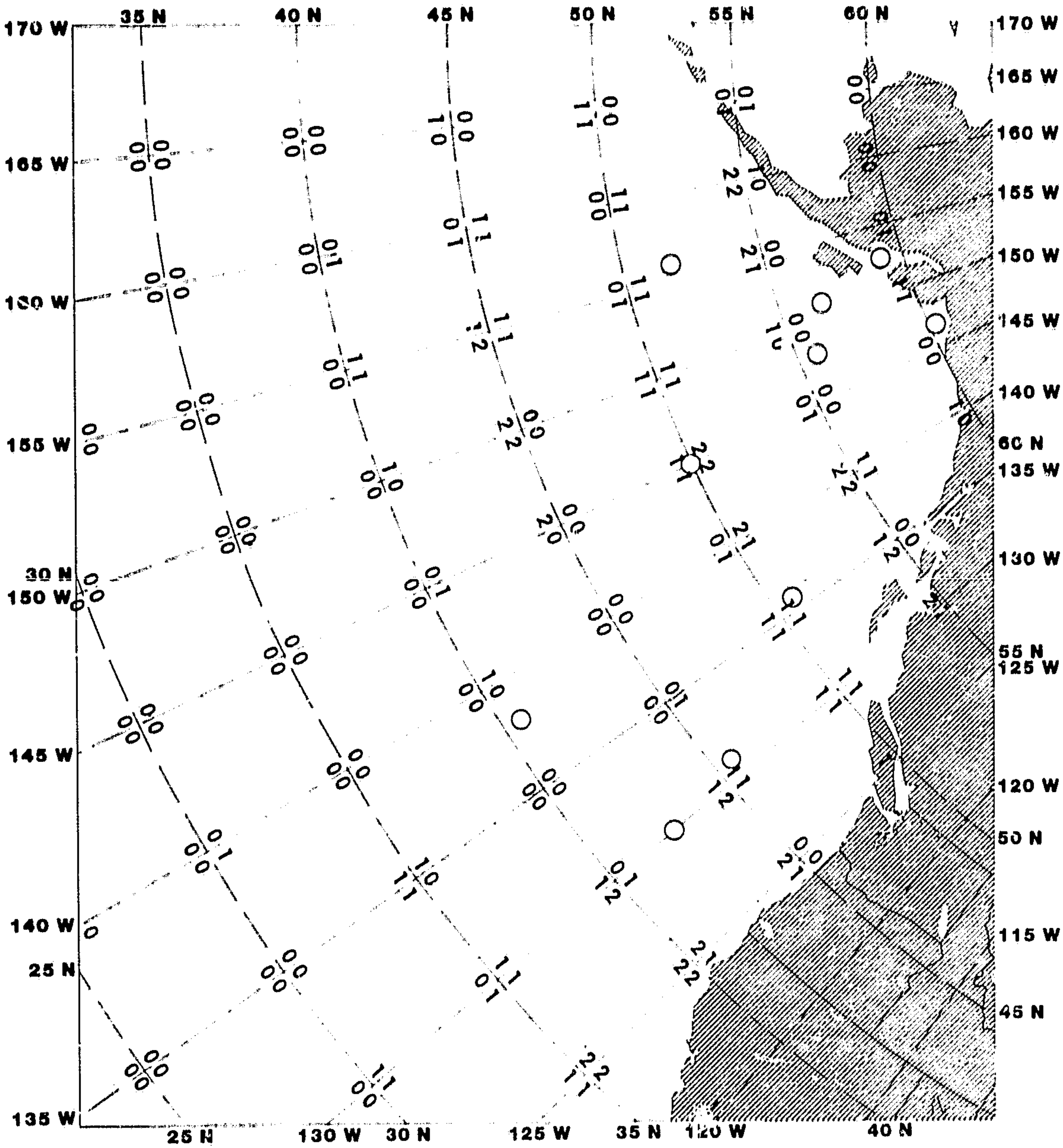


0900 GMT 25 SEPT 1978 **REV 1292**

SURFACE WINDFIELD, 19.5 m
(ISOTACHS IN KNOTS)



1800 GMT 25 SEPT 1978 **REV 1298**



Confidence Analysis for Kinematic Winds (Cardone), Revs 1134/1135